An Argus Specialist Publication

Computing today

September 1983
80p

Bear off at Backgammon against our ZX81 program

Go shopping for knowledge with Felix

Why software protection won't beat the pirates

Problem-solving on your ZX Spectrum

Define your own characters with our Dragon 32 utility program

SPECIAL REVIEW: We shed some light on the Torch discs for the BBC Micro

BUILD YOUR OWN cortex 16 bit, 64 RAM colour computer

With this powerful machine (featured in Electronics Today International as a constructional project) you have access to highly advanced systems and software developed specially by MPE Ltd for the CORTEX. For business, education, R & D – or simply increasing your knowledge and understanding of computers – it beats comparably priced off-the-shelf machines hands down!

STATEMENTS
IF
ELSE
ON
GOTO
GOSUB
POP
REM
FOR
NEXT
ERROR
INPUT
PRINT
:
?
'
1 UNIT
BAUD
CALL
DATA
READ
RESTOR
RETURN
STOP
TIME
WAIT
SAVE
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MOTOR
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NOESC
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RENUM
BOOT
GRAPH
TEXT
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UNPLOT
COLOUR
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FUNCTIONS
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Standard features –

- High speed 24K byte extended basic interpreter
- Powerful TMS9995 16 bit microcprocessor
- 48 bit floating point gives 11 digit accuracy
- High resolution (256 x 192) colour graphics
- Screen memory does not use up user memory space
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- High speed colour shape manipulation from basic
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- Full renumber command
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- Flexible CALL statement allows linkage to machine code routines with up to 12 parameters
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- Separate 16K video RAM for graphics

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£295

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RS232C interface kit	£9.20
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Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.

All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.

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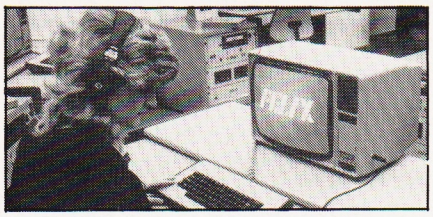

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CONSUMER NEWS

GETTING BOARD WITH APPLES?

U-Microcomputers has released four new Applebus cards: a buffered (16K) printer interface U-PRINT16, a speech synthesis board U-TALK, a disc controller U-4DISC and U-CENT, a low-cost Centronics parallel interface.

U-PRINT16 provides parallel or serial interfacing, has a 16K buffer so that the computer is quickly freed up and can also print graphics directly to the Epson and Apple dot matrix printers.

The U-TALK is a versatile speech synthesis card using National Semiconductor's DIGITALKER speech set. The U-4DISC is a unique Apple compatible disc controller card that allows up to four drives to be attached rather than the usual two. The U-CENT is a no-frills, low-cost parallel (Centronics) printer interface; it comes complete with cable and allows eight-bit data transmission, so users can generate their own graphics dump software.

The prices are: U-PRINT16, £130, U-TALK, £95, U-4DISC, £85, U-CENT, £69. For more details contact U-Microcomputers Limited, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire or phone 0925-54117.

FOR WHOM THE MICRO TOLLS . . . ▼

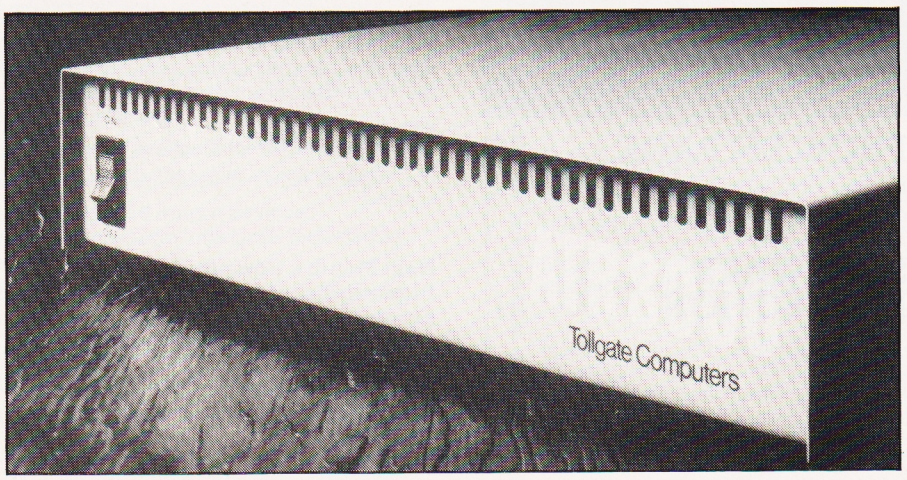
Tollgate Computers announce the availability of the ATR 8000, a combined CP/M Maker and high performance flexible Disc Operating System for microcomputers. The ATR 8000 is specifically aimed at the Atari 400/800 user who can now use their micro as an improved business machine supporting the popular CP/M operating system. The ATR 8000 can also serve as a flexible peripheral interface to almost any microcomputer system with an RS232 port. For the Atari user, the enhancements provided are double density Atari DOS, increased storage capacity, CP/M operating system and an RS232 and Centronics interface. To the non-Atari user, the ATR 8000 allows the conversion of almost any microcomputer or terminal into a CP/M machine at an affordable price.

The pricing is as follows: ATR 8000 (with 16K RAM), £399; OS/A+ (version 4), £49; CP/M Upgrade Kit (including 64K RAM), £199; 5¼'' Disc Drive Cable (four drives), £24; 5¼'' Disc Drive Cable (two drives), £19; and Printer Cable (serial or parallel), £24. If you would like more information please contact Tollgate Computers Limited, 35 Claydown Way, Luton, Bedfordshire LU1 4DU or phone 0582-32752.

FAT CAT

The new 96K version of the Lynx microcomputer appeared in June and is available from retailers for £299 including VAT. The expanded RAM of the 96K Lynx provides 37.5K directly accessible to BASIC in high resolution full colour, with up to 24K more available to programs using machine code. At 20K, the ROM is 4K larger than that of the 48K Lynx; additional ROM features include drivers for both parallel and serial printers, a range of pre-formatted sound effects, CIRCLE command and commands to use the 24K of machine code accessible RAM as a data store for programs running in BASIC.

Owners of the 48K Lynx will be able to have their machines upgraded to full 96K specification through their Lynx dealers who will arrange for the machines to be returned to Camputers for upgrading. The price of the upgrade will be £89.95 including VAT.



GETTING STARTED

Commodore have launched their biggest ever promotion featuring the VIC-20. Special VIC-20 boxed sets have been made available in retail outlets and selected Commodore dealerships. Designed particularly for the first time buyer of a home computer, for just £139.99 including VAT, the limited edition packs contain a VIC-20, a cassette deck, **Introduction to BASIC Part 1**, and four cassette games: Blitz, Hoppit, Race and Type-a-Tune. The current retail price if all the items were sold separately would be £249.99.

GETTING IN PRINT

If you don't have access to a printer and you own a BBC Micro you may find that some of your troubles are over. BEEBPRINT will despatch, by return of post, a high quality printed listing from 1200 baud cassettes. All material will be treated in the strictest confidence and tapes returned with the listings.

The costs involved are: program listing (maximum block count — &20), £1.95; excess charge for programs over &20 blocks, 20p per nine blocks; extra programs (on same tape), £1.00; extra programs (on separate tape), £1.50; 300 baud tapes, 50% extra; high resolution screen dump (needs line added to program), 50p. All prices include postage and packing. Tapes recorded with an 0.1 OS should use the Cassette Bug-fix recommended by Acorn.

For more details on this service why not write to BEEBPRINT, 19 Orchard Way, Hurstpierpoint, West Sussex BN6 9UB or phone 0273-833397.

BILINGUAL BEEB

JWB-FORTH V2 is a FORTH language ROM which simply plugs into a spare location in the BBC Micro. It will work with any current operating system and is fully compatible with disc and net

use as well as cassette. It allows full use of all graphics modes, whereas no cassette version does this; all MOS calls are supplied and a text and string editor are included. JWB-FORTH V2 is being used by educational establishments, hospitals, the Ministry of Defence and the BBC as well as by many individuals. The program is fully supported and extensions include full floating point representations and graphics extension.

The program ROM and documentation costs £34.72 excluding VAT and a manual entitled **Welcome FORTH** costs £6.75 exempt of VAT. Both are available only from HCCS Associates, 533 Durham Road, Low Fell, Gateshead, Tyne and Wear NE9 5EY or phone 0632-821924.

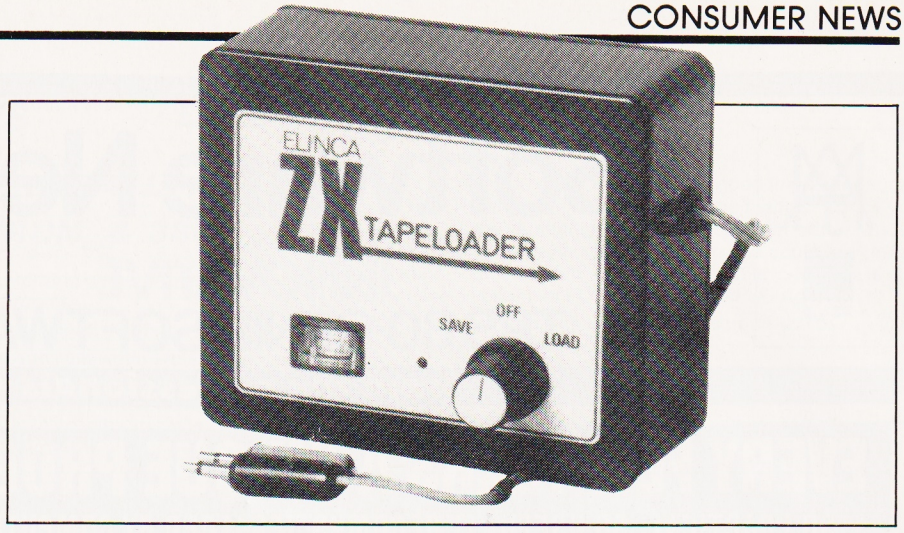
GETTING LOADED

Elinca Products have announced the introduction of a new tape loader for use with the ZX81. The ZX tape loader has been developed to solve problems of computer LOADing and SAVEing, particularly when using a conventional tape recorder. The ZX tape loader filters and stabilises signals in both directions, providing a constant signal perfectly matched to the computer; A major problem encountered when using a standard tape recorder for loading, due to lack of volume measurement and control when the recorder is switched to 'play', is eliminated with the ZX tape loader, which incorporates an audio output indicator and signal amplifier to enable the correct computer input signal to be used.

The new unit also filters out any unwanted signals and hum from the tape recorder. Plugging and unplugging of leads from input and output sockets, when changing from LOAD to SAVE is also not necessary with the ZX tape loader which has a built-in three-way switch, SAVE, OFF and LOAD. The ZX tape loader retails at £14.99 and details can be obtained from any major stockist or direct from the manufacturers, Elinca Products Limited, Lyon Works, Capel Street, Sheffield S6 2NL or phone 0742-339774.

BRIEFING

Diamond Stylus have produced **Screenwipes** which as well as being suitable for cleaning TV/monitor screens, also ideal for removing dirt and marks from keyboards, computer and printer cabinets, clear equipment covers,



telephones, storage equipment etc. Screenwipes not only clean, but effectively remove and inhibit static from the treated surfaces and finally freshen, by means of a slightly perfumed additive. The retail price including VAT of a 'pull-out' can of 50 wipes is £2.42, and we can testify to the fact that they work — the micros in our office have a much improved appearance! For more information contact **The Diamond Stylus PLC,** Colwyn Bay, North Wales LL28 5HD or 'phone 0492-40202.

If you're not doing anything on Friday 16 September (9.30 am to 8.00 pm) or on Saturday 17 September (9.30 am to 5.00 pm) then why not go along to the **Sutton Library Computer Fair** which is to be held in the Central Library, St Nicholas Way, Sutton, Surrey SM1 1EA. The last fair was a great success and there will be a wide variety of exhibitors there including the Association of London Computer Clubs.

The **Juki 6100** is a low-cost 18cps daisywheel printer designed for word processing use with personal and small business micros alike. The Juki 6100 is a full-featured daisywheel emulating Diablo 630 protocol and is fully compatible for use with Wordstar. It has a wide variety of features and a Centronics compatible interface is provided as standard with an RS232 serial and current loop interface as an optional. Paper handling is either by friction feed or optional tractor feed. Available at £399 excluding VAT, further details are available from **Micro Peripherals Limited,** 69 The Street, Basing, Basingstoke, Hampshire or phone 0256-3232.

Working with Computers is a new booklet from the Royal National Institute for the Blind, which shows blind people at work at every level of data processing. Sixteen pages of photographs and text describe special equipment including terminals with speech or braille output and conversion of print into tactile form. Such equipment is financed by the Manpower Services Commission and does not involve employers in extra expense when employing visually handicapped staff. The booklet also demonstrates how blind programmers write flow charts and structure diagrams and describes the training given by the RNIB. The booklet is available free from **RNIB,** 244 Great Portland Street, London W1N 6AA. (Question — why are none of the pages in Braille?)

Sending floppy discs by mail can be risky business; physical pressure, overheating or static charges may damage or destroy data stored on the disc. Anti-static floppy disc envelopes recently introduced by Willis Computer Supplies offer protection in a number of ways. A solid hard cover prevents twisting or folding; the envelope lining is an elastic foam material which both absorbs physical pressure from the outside and is permanently anti-static so that conductive charges cannot build up. The new envelopes are self-sealing and are available for 5¼" and 8" discs. There are two types, to contain either five or 10 of either size of disc. For more information contact **Willis Computer Supplies Limited,** PO Box 10, South Mill Road, Bishop's Stortford, Hertfordshire.

ER, SORRY

I have to admit it — I do make mistakes! My apologies must go to two companies (and all readers) for an error in the Supplier information given with the FX-20 16-bit micro survey in the July issue of *Computing Today.* In the issue I stated that the supplier of the FX-20 was Future Technology Systems of Ayrshire. This is incorrect and should have read Future Computers Limited, PO Box 306, Purley, Surrey.

My thanks to those readers who phoned in.

Software News

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from the professionals

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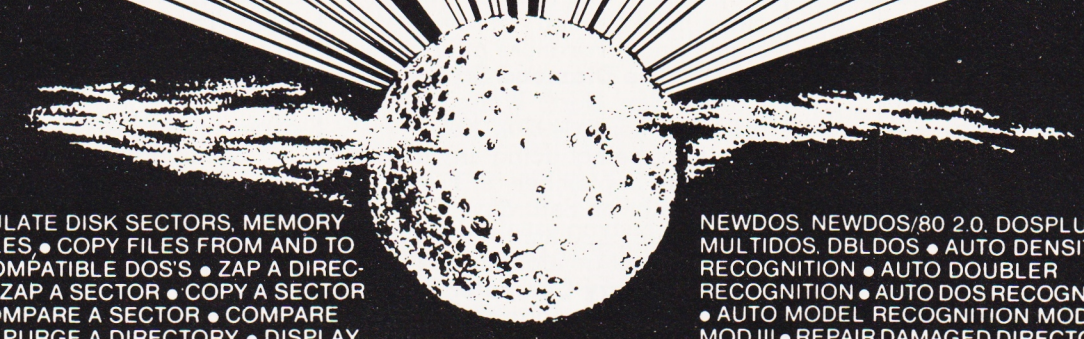
VERSION 3.0

SUPER UTILITY PLUS



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- *Chris Green (customer) April 83*

2) ADVENTURE QUEST: Through forest, desert, mountains, caves, lake, fire, moorland and swamp on an epic puzzle journey.

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3) DUNGEON ADVENTURE: "massive adventure with more than 100 puzzles to solve. Rich vein of humour throughout." - *The Micro User June 83.*

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BBC FORTH £15

"For your money you get not only a very good implementation of the popular FORTH language but also a 72 page manual ...Once you have got an idea of the fundamentals you should get better value out of this pack than virtually any other program you could buy. In fact, the only reason I can think of for not buying this cassette is that you already have a version of FORTH!" - *LASERBUG April 83*

"rqFORTH is fast and has a first-class screen editor . . . Overall, a good buy"-*Computing Today July 83*

rqFORTH costs just £15 (inclusive) and runs on 16K or 32K BBC micros. It:

- ★ needs no added hardware and works with any MOS version;
- ★ works with cassette and disc;
- ★ is FORTH-79 STANDARD and has fig-FORTH facilities;
- ★ provides 260 FORTH words and is infinitely extensible;
- ★ allows full use of the MOS via *MOS, CALL and EMIT;
- ★ permits use of all graphic modes, even 0-2 (just!);
- ★ has an excellent full-screen editor;
- ★ runs faster than BBC BASIC;
- ★ includes a 72 page manual, a 20 page disc supplement and a summary card for quick reference;
- ★ is used by hundreds of people, worldwide.

BBC FORTH TOOLKIT £10

"Level 9 promise to support rqFORTH and this pack proves it. It provides the source code for all sorts of useful routines and examples of how to program in FORTH. With so much on one cassette it would be good value at twice the price." - *LASERBUG April 83*

The rqFORTH toolkit costs just £10 (inclusive) and adds the following facilities to FORTH:

- ★ a full assembler, providing machine-code within FORTH;
- ★ turtle graphics, giving you easy-to-use colour graphics;
- ★ decompiler routines, allowing the versatile examination of your compiled FORTH programs;
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- ★ an example FORTH program and demonstrations of graphics;
- ★ other useful routines.

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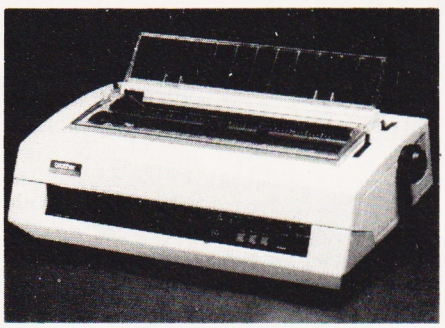

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In fact most computers!

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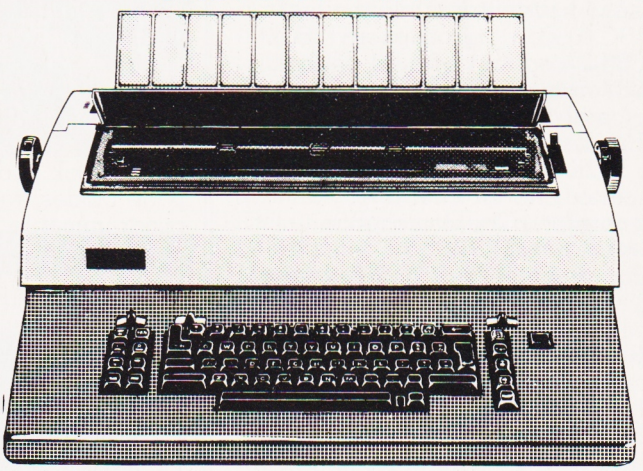

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BUSINESS NEWS

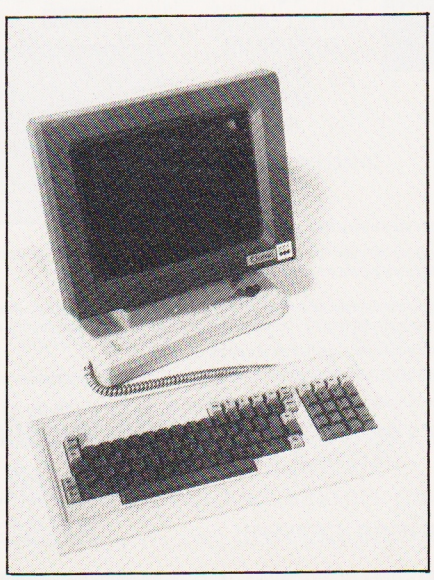
SANYO LAUNCH ▲

Sanyo have introduced the MBC4050, a high capacity 16-bit 8086-based unit with an optional 8087 numeric data processor at a price of £2450 excluding VAT. This desktop micro offers from 132 to 512K RAM and 6K ROM (4K monitor and 2K character generator). The detachable keyboard features 15 programmable function keys and five cursor control keys, a built-in palm rest and deep-dished keys. The MCB4050's 12" non-glare screen displays 256 different character (8 by 12 matrix) on an 80 characters by 25 lines format.

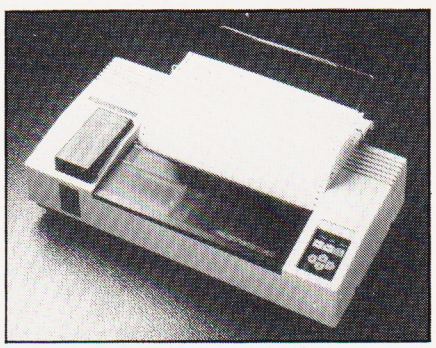
Two 5¼" double-sided, double-density, double-track slim type disc drives are included giving 1.2 Mb capacity. The micro runs under CP/M 86 and supports S BASIC 86, BASIC 86, ASM 86, DDT 86, ED and LOAD 86 which are included. Interfaces include an RS232C port and a Centronics type parallel printer interface. For more information, please contact Sanyo Marubeni (UK) Ltd, 8 Greycaine Road, Greycaine Estate, Watford, Hertfordshire WD2 4QU.

WATCH IT

Qume's latest product is the Qume QVT-102 CRT Terminal. Some features of the terminal include simple menu selection, non-glare screen which tilts and swivels, low detached keyboard, Line Block, Page Block and Unprotected Block page modes, four separate programmable function keys, line drawing, graphics characters, 9 by 12 character cell resolution, 24 lines by 80 characters plus a 25th status/menu set-up line, screen-saver time-out, self-test, switching power supply and RS232C interface plus current loop, with DTR and X-ON and X-OFF protocols.



Access Data Communications, London's main Qume distributor, offer on-site service contracts or return-to-base repairs for all products they supply. The Qume QVT-102 is being offered at a price of £569 or £512 cwo. For further information please contact Access Data Communications Limited, Unit 17, Eskdale Road, Uxbridge Industrial Estate, Uxbridge, Middlesex UB8 2RT or phone 0895-59781.



PLOTTING TOGETHER ▲

Environmental Equipments have introduced their new A3 size Plotwriter into its Watanabe range of digital multi-pen XY plotters. The Plotwriter is a drum plotter with a built-in print facility — compact in size, lightweight and designed for desktop use. With four pens which can be automatically exchanged to provide colourful graphs and drawings, the Plotwriter can be switched easily from a graphic to a print mode using input signals and will print rapidly at a speed of seven characters a second in European, Greek and Katakana type faces.

The plotting speed is 200 mm per second; the Plotwriter can draw straight lines, broken or unbroken circles and curves and will rotate or italicise type characters to 0.1 degree. Graphics or bar charts can be drawn with solid colours or hatching — to a choice of angles and line spacing. Three types of interface can be selected — RS232C, GP-IB (IEEE) or eight-bit parallel. At a price of £1531, plus interface, you can get more information from Environmental Equipments (Northern) Limited, Environ House,

Welsh Row, Nantwich, Cheshire CW5 5ES (phone 0270-625115).

IBM DRIVES ONWARDS

The new Europa System G101 Display Multiplexer will drive up to five colour displays from the direct output socket of the IBM Personal Computer, which makes it possible to show the computer colour display to a large gathering for demonstrations, teaching and marketing purposes. Any display may be used if it is suitable for connecting to the computer direct drive colour output socket.

The Display Multiplexer is transparent to all alpha/numeric and graphics signals and features fully buffered line drivers, high noise immunity CMOS integrated circuits and an integral stabilised power supply for operation from 120/240 volts 50/60 Hz mains. The standard cables allow each colour display and the computer to be positioned up to five metres from the Display Multiplexer. The cables connect to the front panel with latching 'D' type subminiature connectors.

The price of the Display Multiplexer is £262, the input cable from the P.C is £24 and output cables to the displays are £19 each. VAT should be added to the prices. More information can be obtained from Europa Systems Limited, Biggin Hill, Westerham, Kent TN16 3DF, or phone 29-71165.

NEW PRINTER RANGE ▶

A new range of printers designed for use with the ACT Sirius 1 and other microcomputers has been launched by the newly formed Office Products subsidiary of computer group ACT. The Writer range consists of five machines: the ACT WRITERs 10, 12 and 14 matrix printers, the ACT WRITER 20 matrix NLQ printer and the ACT WRITER 30 daisy wheel printer.

Quick delivery should be achieved as all machines will be available ex-stock, the aim being to provide all ACT's 400 dealers with off-the-shelf supplies. The accent will also be on fast field maintenance with 40 engineers on station. The most novel feature of the range is the three-speed facility of the WRITER 20 model which allows the user to select high speeds for data processing or drafting or a near letter quality mode for correspondence.

At the bottom end of the range is the inexpensive and portable WRITER 10 model, and at the top the WRITER 30 daisy-wheel printer designed for word processing applications, or in business systems where the standard of finished work is paramount. Under the label WRITER 90 is the ACT Automatic Sheet Feeder which allows full page printing and automatic transportation to the output hopper.

The WRITER 10 matrix printer for up to four part stationery at 120 characters per second costs £395 plus VAT. The WRITER 12 matrix printer with a 136 column carriage handling up to full width 15" continuous stationery costs £695 plus VAT. WRITER 14 matrix printer, heavy duty for up to five parts stationery at 150 cps costs £1295 plus VAT. WRITER 20 matrix NLQ printer, capable of fast, draft and correspondence speed costs £995 plus VAT. The WRITER 90 automatic single sheet feeder costs £595 plus VAT. For more details please contact Applied Computer Techniques, ACT House, 111 Hagley Road, Edgbaston, Birmingham B16 8LB, phone number 021-454 8585.

BRIEFING

A new low-cost method of safely posting and transporting floppy discs is here: constructed of heavy duty 90 lb board stock, the **Sentinel Floppy Disc Shipper** envelope for standard and mini discs provides positive resistance to any destructive bending. A smooth polyethylene foam lining eliminates abrasion during transit or loading operations while its anti-static properties prevent dust caused by static. For more details and pricing information please contact **Kennet Packaging Limited,** Unit 5, Station Road, Thatcham, Newbury or phone 0635-66552.

A new anti-glare treatment kit, **Glarego,** has been introduced. Specially developed to provide a lasting non-reflective surface to TV screens, computer terminals and glass-fronted pictures, Glarego is easy to apply; simply prepare the screen with the Cleanscreen provided, then spray on Glarego. The price is £7.95 including VAT but excluding postage. For more details contact **Vision Products,** Unit 10, Wessex Road, Bourne End, Buckinghamshire SL8 5DW or phone 06285-29997.

Datac have introduced a range of 40 column printers which print at high speed on plain paper in red or black. One unit is priced as low as £155 for the end user. These boxed printers are supplied as desktop or panel-mounted versions. **Model 510,** the desktop unit, measures 197 mm by 240 mm by 74 mm and the panel-mounted model, **520,** measures 150 by 149 by 199 and costs £165. The printers are easy to interface to a micro as serial as well as parallel interface boards are available for control electronics and character generation. A serial dot matrix impact system is used to print 40 characters per line (5 by 7 matrix) on 70 mm wide paper at 1.2 lines per second. Further details are available from **Datac Limited,** Tudor Road, Altrincham, Cheshire WA14 5TN or phone 061-941 2361.

BFI Electronics, major distributor of **Verbatim floppy discs,** have announced the availability of two-disc packs for retail outlets; the new twin packs will appeal to small users who at present can only buy discs boxed in 10s. The required average outlay will thus be reduced from over £30 to under £6 per purchase. The discs involved, 5¼" types suitable for most of the personal computer disc drives currently available, are from the Verbatim 'Datalife' Series. More details can be obtained from **BFI Electronics Limited,** 516 Walton Road, West Molesey, Surrey KT8 0QF, or phone 01-941 4066.

The book **Computer Insecurity** is by Adrian R. D. Norman. The author has tried to open the eyes of his readers to the risks associated with computer systems and to this end has brought together a compendium of other people's mistakes. Over 100 crimes, errors and disasters involving computer systems are listed. This book is directed at those who must now or expect later to have to make decisions or advise decision makers about computer security. The book is published by **Chapman & Hall,** is hardback, has 366 pages and costs £14.95. The ISBN is 0 412 22310 4.

Value - MicroValue - Micro

COMPUTERS

Gemini Galaxy 2

"I would place the Galaxy at the top of my list"
(Computing Today, April 1983)

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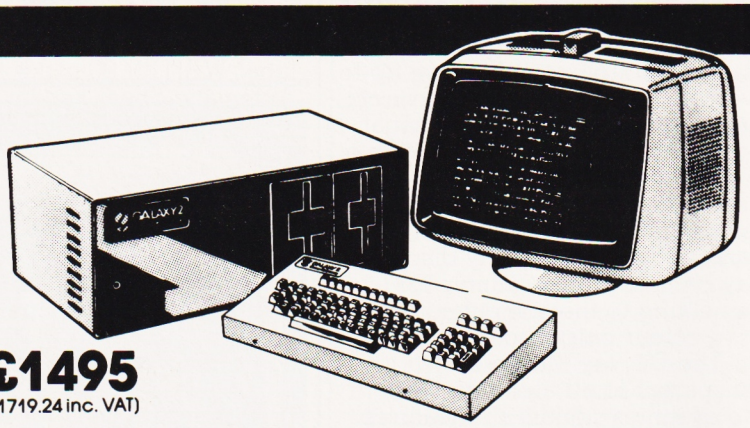
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numeric key pad
- ★12" Monitor included



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Total support for Gemini & nascom Products

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Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.

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NASCOM 2 KIT
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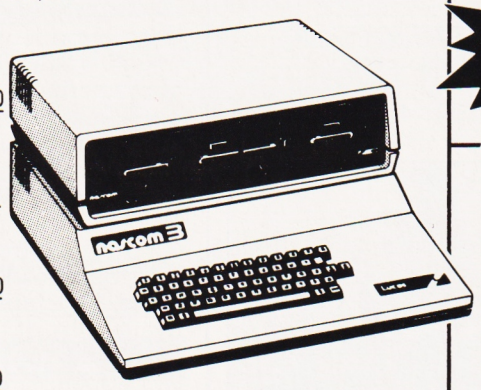

80x25 Video for nascom

£125
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Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

The **Microvector 256A** is a high performance graphics display interface on an 80-BUS and NASBUS compatible card. Various graphic primitives such as vector and character generation are executed in hardware by a Thompson EF9356 Graphic Display Processor. Plotting rates are typically 1 million pixels per second giving full animation capability. Various vector and character types can be selected. Characters can be scaled to give 256 different sizes.
MV 256A Suitable for TV use (PAL-UHF) **£199.00** + VAT
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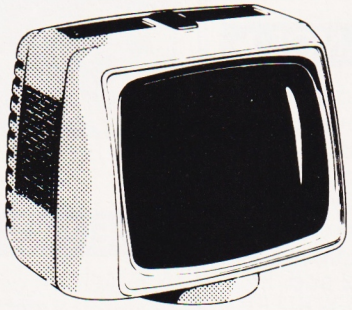

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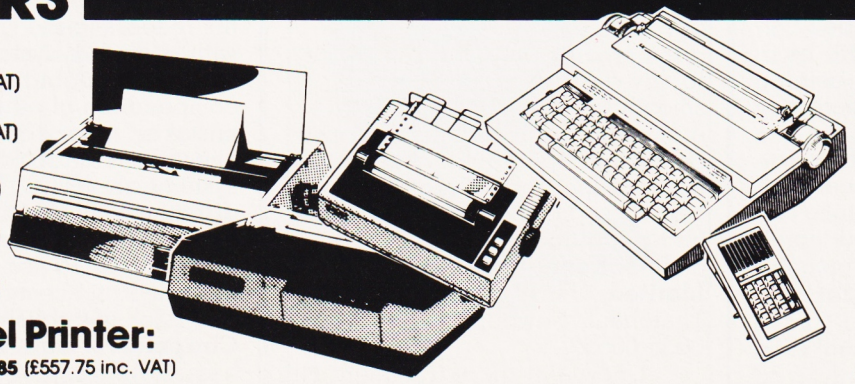

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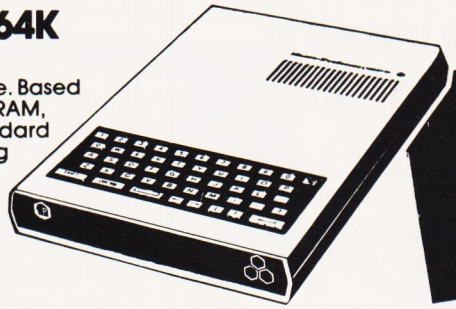

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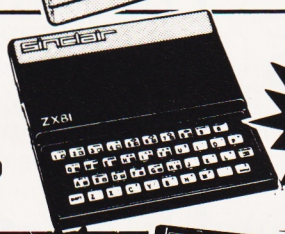

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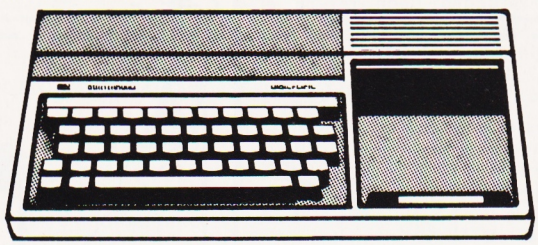

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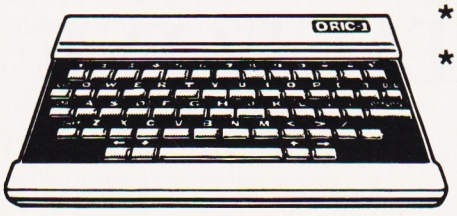

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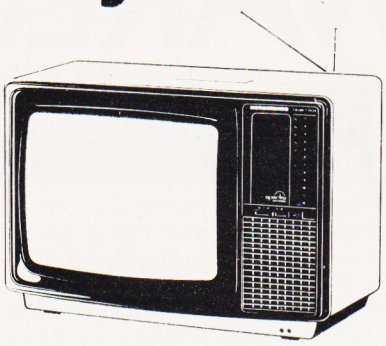

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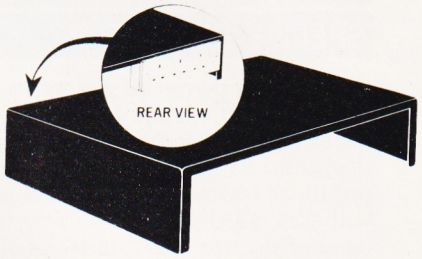

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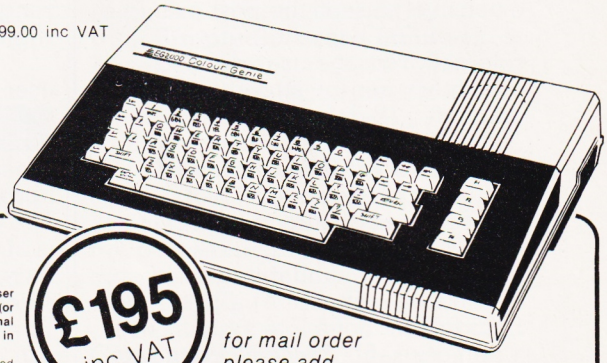

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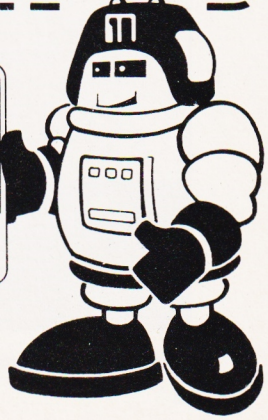

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SOFT WARES

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Rescue is a powerful data base management system for CP/M and MSDOS microcomputers. It is designed to deal with large numbers of records; for example, it will sort 3000 records on any field (including non-key fields) of 10 characters alphabetically in ascending or descending order in only 3 minutes and 16 seconds. Extraction of records can be defined by setting up to 40 separate selection criteria. Data validation at run time makes data entry fast and easy; any invalid entry is immediately rejected with a clear error message telling the operator what is expected.

Data compression is extensively used; the best example is that a 60-character entry selected from the user-defined dictionary can be stored with only one byte; 18 data dictionaries of 255 entries can be used per data base and 20 data bases are available per system.

Rescue is claimed to provide many features and facilities normally only available on mainframe systems. At a price of £295 for the complete system, with a demonstration system costing £35, you can get more details from Microcomputer Business Systems (UK) Ltd, 5 Charterhouse Buildings, 27A Goswell Road, London EC1M 7AN, or phone 01-253 3998.

THE ANSWER LIES IN THE SOIL

Cambridge Applied Technology has recently developed two revolutionary aids for the amateur gardener for use in the comfort of his own home. Available for the BBC Micro Model B, the programs are Greenfinger:Garden plant selector and Garden layout planner.

The plant selector is a program for automatically selecting the plants which will thrive best in a given location within a garden. The computer asks the gardener about the type of soil, available sunlight and moisture and searches its memory for plants which best suit the conditions within a given range of height. The system gives rapid access to over 400 plants.

With the layout planner, the user can tell the computer about the existing or planned sizes and positions of buildings, walls, greenhouses, paths, patios, borders, beds, trees and shrubs. The computer asks where the sun is at noon and amazingly plots a fully-scaled plan view on the screen.

At a price of £12.95 each, you can afford to dig into your pockets and completely redesign your garden. For more details write to Cambridge Applied Technology, 51 Hinton Road, Fulbourn, Cambridge CB1 5DZ or phone 0223-880958.

USEFUL EDITOR

A new, moderately priced (£60 plus VAT), text editor has been released by Lutterworth Software for the Apple II. It is intended for users such as magazine editors, who need to produce short length lines in several columns, hence the name: COLTEXT. The screen shows all text in its output format, with single-key centreing and right-left justification immediately displayed. The same text can be outputted in any number of columns, all without reverse line feed. Lutterworth Software, who specialise in one-off turnkey systems for a wide range of micros, will supply a free sample and manual to enquirers; write to 6 Cromwell Close, Walcote, Lutterworth, LE17 4JJ.

SERIOUS STUFF

Ramtop Software, a new serious software company, have announced their first three business tapes for the 48K ZX Spectrum. The Purchase Ledger, Sales Ledger and Sales Journal comprise a complete book-keeping system; it is a one-entry system based on the Simplex book-keeping system, which makes it extremely easy to use. It is intended for businessmen with little or no knowledge of book-keeping who may never have seen a computer.

The tapes sell at £24.95 each (£60.00 for all three tapes) and this means that small businesses can equip themselves with the 48K ZX Spectrum, ZX Printer and software for under £300. A manual is provided which explains the system and how to use it. Ramtop are also producing a number of educational tapes for the Youth Training Scheme and schools and colleges.

Customer advice and help will be provided at the end of a telephone if needed, and demonstrations will be arranged locally. For sales enquiries please contact Ramtop Software on 0744-59883 (0928-701428 after 5.00 pm and weekends). Dealer enquiries are welcome and should be addressed to Ramtop Software, 12 Milnthorpe Road, Burtonwood, Near Warrington, Cheshire WA5 4PN.

PINBALL WIZARD

The Pinball Construction Set builds video pinball games for your Apple II personal computer, although it is claimed as much

more than just another game utility or development tool. To let you touch your Pinball Construction Set, a video 'hand' is included which you can control with your joystick; by moving the joystick lever you propel the hand on the screen, and you can make the hand grasp or select whatever it is touching, enabling you to build your pinball machine from pieces in your parts box. The set contains the pieces and tools to make millions of hi-res video pinball games; no programming or typing is necessary, just take parts from the set and put them on the game board, press a button and play. Available from Pete & Pam Computers, the set costs £27.95.

Three new games written in GraFORTH for the Apple II (48K) with DOS 3.3 are also available from Pete & Pam Computers. They are Zargs, a space fight with four levels of play, Grapple, which isn't as varied as Zargs but has more skill levels, and Spider Raid, in which the player is a mighty spider and has to deal with all sorts of obstacles and enemies in order to get food — the common house fly. All games cost £19.95 plus VAT. For more details of these products, contact Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG.

MORE FOR LESS

Sinclair Research is cutting the cost of its best-selling 16K ZX Spectrum from £125 to £99.95. Sinclair, which earlier this year announced its one millionth computer sale, has also reduced the larger 48K ZX Spectrum from £175 to £129.95 and will now sell its ZX Printer at £39.95 as against £59.95 previously, all prices including VAT. In an extension of its ZX81 and ZX Spectrum software library, Sinclair Research have launched nine new cassettes. For users with programming interests, the new FORTH program offers a language combining BASIC's

simplicity with the speed of machine code. Games for the ZX Spectrum include Cyrus-IS-Chess, The Spiders, Scrabble and Backgammon. For the ZX81, Sinclair have introduced two new adventure games, Sabotage and City Patrol.

Finally, the growing demand for business software is met by the new Small Business Accounts program (48K ZX Spectrum only) which provides balance sheet and profit and loss information together with VAT returns. Ranging in price from £4.95 to £15.95 including VAT, the cassettes are available by mail order from Sinclair Research, Stanhope Road, Camberley, Surrey (phone 0276-685311) and should also be available in major branches of W.H. Smiths, Boots, Currys, John Lewis Partnership, House of Fraser, John Menzies, Greens and other leading chains and computer stores.

MARRYING MICROS

The UCSD p-system, known for its comprehensiveness, adaptability, portability and renowned Pascal compiler, has now been adapted for use with the Nascom/Gemini family of micros. The system is a set of file-handling, compiling, editing, assembling, linking and executing software in one integrated operating system that is portable between different microcomputers — even those with different microprocessors. It is claimed that it will give Nascom and Gemini computers virtually complete software compatibility with IBM, Sirius, Sage and other computers running the UCSD p-system with a tremendous price saving in hardware.

The latest version has been adapted for the Nascom/Gemini family via the Z80 p-code interpreter and comes with a BIOS and, in the case of a Nascom, a boot ROM, all ready to run. Also provided are utilities to reconfigure the drives to read and write discs in virtually any format (including IBM and Sage) via any combination of Nascom and Gemini Controller cards and with a mix of 8" or 5¼" drives.

For more details why not contact Mike York Microcomputer Services, 9 Rosehill Road, London SW18 2NY, or phone 01-874 6244.

BRIEFING

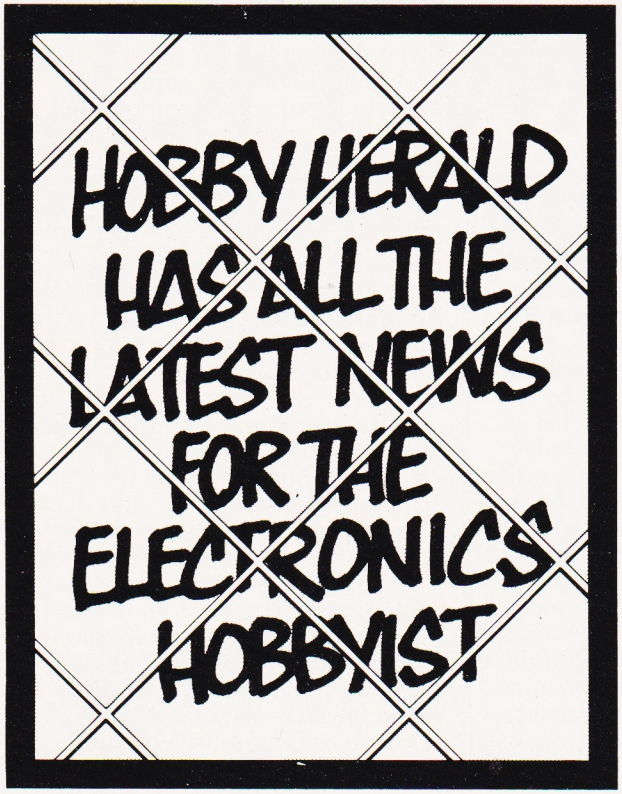
A new mail order software company has been formed which only sells adventure games for almost all personal computers, and to act as a forum for adventurers to swop ideas and hints and also to help people who are stuck (if they can) regardless of where they purchase their program. If you would like a free copy of their catalogue, why not write to **Adventure-Zone Software Limited,** 10 Ennis Close, Harpenden, Hertfordshire AL5 1SS.

The word processing program **Simply Write**, popular on the PET/CBM, has now been completely rewritten for the Commodore 64. Complete with such facilities as mail-merge and the ability to load and join stored files, Simply Write for 64 is a full-feature word processor suitable both for business letters and for long essays and reports. **Simply Write for 64** costs £35 plus VAT on tape and £40 plus VAT on disc and is on sale from dealers or direct from **Simple Software Limited**, 15 Havelock Road, Brighton, who will be happy to send full details to readers.

Deskmaster 9 RAM Database is the latest in the Deskmaster series of application programs for the portable Epson HX-20. The data base is available in two forms, 16K and 32K, and both versions cost £29.50 plus VAT from **Kuma Computers Limited**, 11 York Road, Maidenhead, Berkshire SL6 1SQ.

K-BASE is an information storage and retrieval system specifically developed for users with no previous computing experience. Easy to learn and operate, the program is written in BASIC and can be used without modification on a wide range of microcomputers. K-BASE 83 is available at £340 from **Katotek Design Systems Limited,** 9 West Way, Oxford OX2 0JB.

Systematics International Microsystems have launched three new business programs for the IBM PC, Sirius 1 and Apple IIe. The **Administrator Program** offers both data base and addressing and mailing facilities (£175 plus VAT), the **Systematics Word Processor** is priced at £175 plus VAT and the **Systematics Payroll** costs £350 plus VAT. For more information contact **Systematics International Microsystems Limited,** Cleves House, Hamlet Road, Haverhill, Suffolk (phone 0440-61121).



When you need to update yourself with all that is available in the "Do-it-yourself" market, then you need the Hobby Herald.

Packed with product information essential to the electronics enthusiast, this new electronics catalogue lists over 60 exciting products ranging from All Purpose Cutters to Verobloc, the solderless breadboard. All products are available throughout the U.K. from over 200 stockists.

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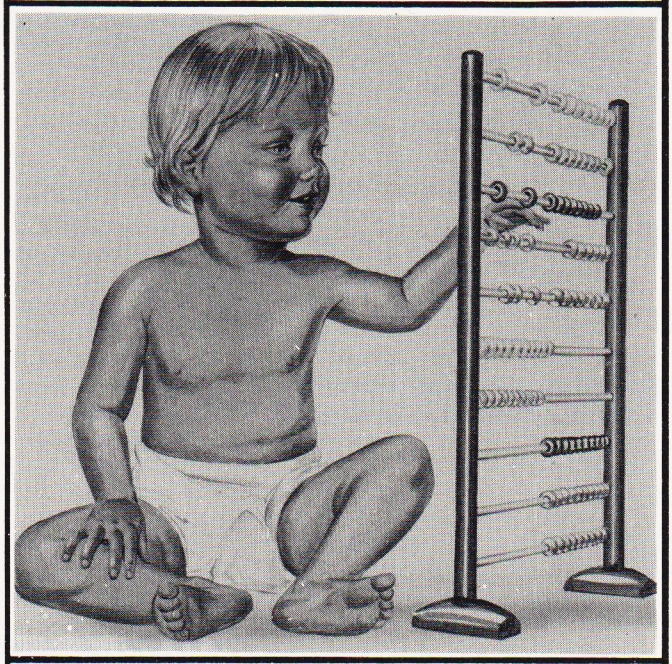

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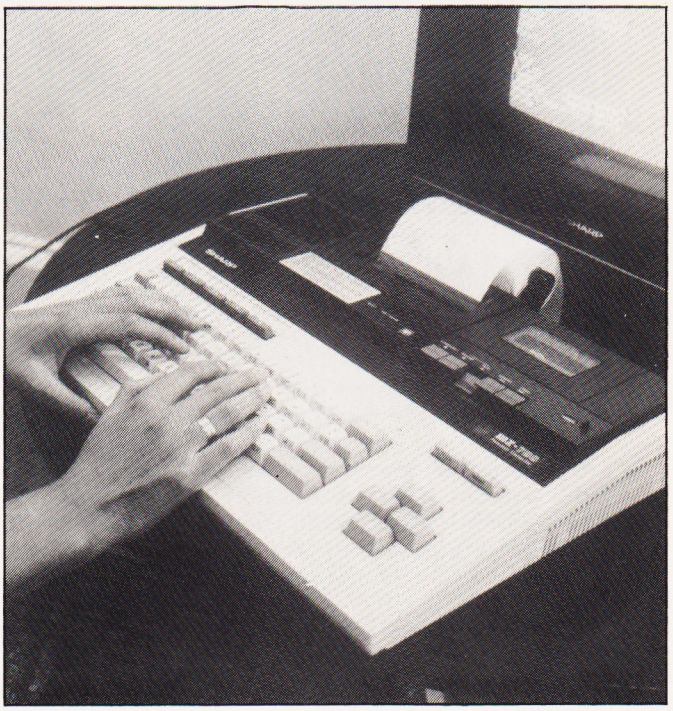
NEXT MONTH

computing today

OCTOBER ISSUE ON SALE SEPTEMBER 9th

LOOKING SHARP

Although their marketing successes in other fields of technology have been substantial, the Japanese have never really had more than a foot in the door of the personal computer market. This is surprising, considering the technical excellence of some of their products; the Sharp MZ range is a case in point. Now Sharp claim to have woken up to their failings, and have announced some new machines and a new marketing strategy. We'll be looking at both the home and business machines in an in-depth review next month — find out if the Japanese have got it right at last.



A BETTER DOS

Silly old TRSDOS — it only supports the use of 35 tracks per diskette, and doesn't give you the option of declaring drive parameters to rectify the situation. If you're a Tandy/Genie disc drive user and you don't like wasting 12½K per diskette, read next month's Computing Today. The patches are simple to use and written in BASIC, so you don't have to get your hands dirty with machine code.

COMBAT

Are you fed up with those unrealistic space war games that conveniently ignore such real life trivia as inertia, friction, gravity and so on? Here's a two-player game with a difference — when you shoot at your opponent's ship, the missile's trajectory is influenced by the gravity of the planets it passes. The program is written in BASIC, so it's easy to read and easy to convert for other machines. Get to grips with the inverse square law in the October Computing Today.

ADVENTURING WE WILL GO

Brave editorial staff have risked life and limb descending into dark caverns, eerie tombs and the remotest memory locations of the BBC and ZX Spectrum computers, to bring you software reviews of the more devious adventure games around. If your life seems incomplete unless you're searching the desert wastes for a fishing net, wait until next month, then GET CT and READ CT. (But don't GO NORTH without a space suit!)

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

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Peter Green

FELIX KNOWLEDGE SHOPS

A new type of shop opened recently in the heart of London. It sells knowledge. Your editor went along to acquire some.

Much was made of the year of IT. Very little of practical value seemed to some out of it. One of the very few successful independent commercial enterprises to emerge has been Felix Learning Systems Ltd, and the first of their franchised Knowledge Shops opened its doors to the public at the end of May. I went along for a morning to play with the equipment and find out more about the company's objectives.

A Knowledge Shop is a place where anyone may go for a session of computer-aided teaching using interactive video techniques. There are a number of independent workstations in a quiet and pleasant environment, and a number of courses to choose from. I tried out a selection of titles, one from each series — Retail Sales, Sales Representative and Personnel/Administration.

THE SYSTEM

Each workstation contains a rack-mounted Apple IIe computer, a Sony U-Matic video recorder, and two Apple disc drives. The student sits in front of a monitor and enters responses on a keyboard. The sound comes via headphones so there are no distractions.

Having selected your course, the floppy disc with the control program is inserted into one of the drives (we'll get to the other one later) and the U-Matic cassette pushed into the VCR. Once the thing is running, the front panel controls are overridden by the computer — no cheating allowed with sneak rewinding!

My first course was entitled "Can I help you?" and dealt with the problems in various retail departments of a large store. First the VCR ran a short film sequence where actors played out the roles of staff, management and customers who can't find the right paint brush, then the control program turned off the VCR and used the screen to ask questions about the various problem areas you identified and how you would cure them. The course alternates in this way between film sequences and question-and-answer sessions, leading you step by step to an appreciation of the finer points of stock control, customer relations, and staff relations. If it *doesn't*, of course, then you've found that you aren't suited to this line of work without actually having to go and make a mess of it in real life.

In case you were wondering, I got an 'A'. Perhaps I'm in the wrong line of work.

The second course I tried was "Remember me?" and involved the trials and tribulations of a couple of sales reps making follow-up calls on their clients. Again, the course consisted of video clips interspersed with questioning, and again I scored fairly highly. Finally came "Just right for the job", which looked at the problems in interviewing candidates for jobs. This turned out to be my weakest area, with a 'B' score. I'll have something to say about the scoring later.

When the session is over, the workstation assesses your performance and plots out graphs on the screen, together with the lettered grades and notes on your rating. This information is also dumped to a printer at the back of the shop, for you to take away and consider; you also get to keep the documentation that came with your course for future reference.

Should you decide to follow up any subject further, you discover that Felix is not just a training centre. The shop has a Viewdata terminal on which you can list any other course relating to your subject running anywhere in the country for up to a year ahead. There is also an extensive range of books, educational video films and microcomputer software packages for sale.

Training material need not just be job-related. A pilot scheme currently under evaluation will use interactive techniques to teach drivers the Highway Code.

IMPRESSIONS

Learning about unfamiliar subjects (and my abilities to deal with them) in this novel fashion was really quite good fun. Felix have worked hard to ensure that you have the optimum working environment: the surroundings are pleasant, the atmosphere is relaxing and informal, and because it's just you and the computer, you don't feel so worried about making a mistake in front of another person and so your confidence increases. Of course if you should run into problems, there's always a member of staff available to give you a hand. You don't have to be a computer genius to use the system: the keyboard keys are colour-coded for special functions, and the screen usually prompts you for the required reponse — yes/no, agree/disagree, or a multiple choice selection. A pad on the desk explains how to operate the system.

A nice touch is the choice of actors: they are all professionals from stage and TV, but they're the ones whose names you never remember. This is less distracting than using someone like John Cleese — you'd be waiting for him to break into a silly walk!

However, there are some aspects of the software that I feel could be improved, despite the fact that Felix have spent a great deal of time and money and used educational psychologists, systems designers and all manner of other experts to design the workstations and courses. First, while the software is generally user-friendly, at one point in the 'interview' package the program asked me to type in three things that I thought the interviewer needed to organise prior to the interview. Three areas for text entry appeared on-screen and the cursor jumped to the start of the first. I typed in a vague guess for the first, hit Return, and then ran out of ideas. Hitting Return again for the second and third answers didn't work; the computer was trapped against accepting a null string. Fair enough for me — I just typed in two lines of gibberish to escape to the next question — but a system aimed at Joe Public ought not to pose even the slightest ambiguity about operation.

Second, the scoring doesn't seem to be sufficiently detailed in its grading. There's straight three-way split, 0-33%, 34-66%, and 67-100% corresponding to grades C, B, and A. So I got a pretty miserable score for job interviewing, yet I was rewarded with a B grade. The sample printout shown here with zero scores still had a pretty encouraging tone, implying that the student only had to sort out a few problems in his attitudes to become a red-hot salesman. Wouldn't it be more useful to have a 20% increment in scores, with grades A-E, and reports for appalling scores like "You are a twit — go and choose something you are better at"? I can understand Felix not wanting to upset sensitive clients, but it might not be very helpful to raise false hopes in people.

I stress that these are rather minor quibbles compared to the extraordinary potential of the system to provide easy and effective tuition.

IN THE FUTURE

Although it is quite possible for any member of the public to walk in off the street, slap down a sum as low as £30 in anything that vaguely resembles money, and sit down at a console, Felix feel that the bulk of their trade will be with companies whose business requires them to undertake localised staff training on a continuous basis. This will come into its own when the country is covered with a network of franchises. Felix plan to make each franchise a specialist in one particular field, law or accounting for example, and for different franchises to swap their expertise when necessary.

Another type of couse that Felix has planned is more of a company assessment to discover which employees are ripe for promotion and can cope with the responsibilities. A typical test will last for an hour, but instead of being able to answer the questions at your own pace, there is a clock ticking away in the corner of the screen. You are presented with situations that, say, a head of department would need to cope with, and like a pilot in a flight simulator, anything that can go wrong probably will. The snag is that while you get one printout giving an assessment at the end as usual, data about your performance is being stored on the second disc drive for separate processing, the report going to the managing director of your company. Hmmmm — hope **ours** isn't reading this . . .

The final exciting prospect is that Felix will be happy to work with a company to tailor-make a training package. For example, if your company already has a training film, Felix can transfer it onto videotape together with the control information for the Apple, thus providing a custom-designed interactive training course. You can decide whether to keep this material for your own employees or allow Felix to offer it to the public.

```
                FELIX LEARNING SYSTEMS
BUSINESS SERIES: MARKETING SALES

Towards Better Sales

"Just Sign Here" - Closing the Sale

This is to certify that on

     ....................................

successfully completed a section of the Felix interactive
training assessment package 'Towards Better Sales'.

Yqu are an over anxious salesman. You are too eager to make a sale
and are afraid of failure. You wish to build up a relationship with
your customer but worry that the personal questions may spoil such a
relationship. You overstress the need to sign, adding extra incentives
in order to reassure your customer.

You are familiar with your product and can present it well, however,
your nervousness shows itself in flippant remarks to the customer as you
gradually become unsure of your ground.

You find it difficult to react to the customer and hope that he will make
the first move. Therefore, you are over anxious when he starts to show
his doubts and objections. You are too eager to agree with the customer's
point of view and find yourself agreeing that your product is indeed too
expensive.

You can easily be distracted by this way of thinking and end up arguing
with your customer about rates of inflation or other factors which do not
directly relate to your product.

If the customer says that he is not ready to buy, you agree to come back
at a later date, thus increasing your own sense of failure and confusing
the customer. When the customer explains his objection you offer an
alternative product immediately. This suggests disinterest in his requirements.

An over anxious approach does not necessarily contribute to a rejection.
Your enthusiasm for your product can create a very positive reaction from
the client. If you have organised your call based on a systematic
approach to demonstrating and explainig the positive plus points of your
product then you will not be wasting your customer's time. You can
be confident that your approach is correct if you ask your customer
pertinent questions about his requirements at the beginning of the appoinment
rather than immediately presenting your product to him. This will give
you both the opportunity to relax and to develop a rapport. Selling is
a profession where the consultative approach can be most successful in
establishing a long term relationship with a customer. The customer
needs to feel that you have his best interests under consideration and that
you will spend your time with him exploring the possibilities of finding
a suitable solution to his problem.
```

Fig. 1. This sample printout is the report for a person who scored 0%. Perhaps the comments should be a bit harsher?

CONCLUSION

Felix has a great future ahead of it, since my only criticisms are of points that could be fixed with no great effort, and indeed, the manager told me that the courses are still being developed and are subject to improvement. The company has combined new effective teaching techniques with a system that can bring home to everyone that computers are tools and not just games machines, and I expect to see Knowledge Shops throughout the country in the not-too-distant future.

By the way, does anyone want to buy a paintbrush . . . ?

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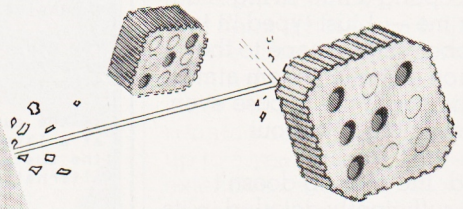
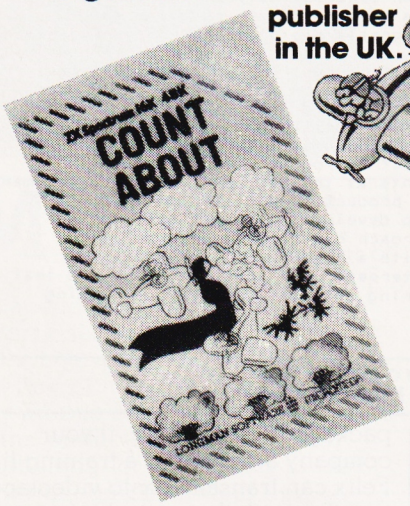


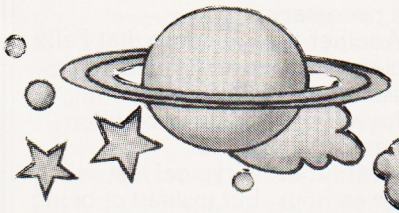


a,b,c... Lift-off! - an exciting introduction to the alphabet that teaches the letters in correct order.
Page through the alphabet picture book and help load our spaceship to Venus by matching pictures and words.
See lift-off with full sound effects!

Hot Dot Spotter - a game of speed and skill that teaches number recognition.
Count the dots (between 1 and 9) and watch the laser beam bounce the ball up the screen. Build up speed and score lots of points.

All programs come with 6 pages of Parents' Notes providing complete instructions for use.

Countabout - Teaches simple addition and subtraction.
Help our micro chimp reach the bananas at the top of the tree by getting the sums right.



Longman Software can be used by children on their own or with initial help from mum or dad.

Available from W. H. Smith, Boots, Menzies, Martins and other leading chain stores, as well as from computer shops and through Websters, Software Directory.
Trade availability through **Prism** Microproducts.
In case of difficulty, or for a full colour brochure, write to:
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£7.95 each inc. VAT

LONGMAN SOFTWARE

Longman Software – The Key to Early Learning

G. Marshall

LANGUAGES IN USE

You can keep on the right tracks with this train simulator which is developed in COMAL and BASIC.

There is something of a shortage of software for simulations. Aside from programs intended purely for educational use in schools and colleges, there is little available for microcomputers. This is a pity because most microcomputers are ideal vehicles for a simulation having, needless to say, the necessary computing power, and also graphics facilities to display the simulation effectively.

APPLICATIONS

Outside the microcomputer field one of the most impressive applications of simulation is in flight simulators. Here computers are used to produce the graphics giving a pilot's view from the cabin of an aircraft. In addition to this, they control the movements of a cabin so that the *feeling* of movement associated with the manoevres of an aircraft is also simulated.

Simulation can also be used to test the integrity of a structure or the stability of an aerofoil. By solving the complicated sets of equations associated with problems such as these and displaying the results, designs can be tested without the need to build the item. Real-time simulation is a valuable tool for examining situations in the real world. It can be used, for example, to examine the effects on the traffic in a town caused by changing the road layout or how air traffic will be affected by a change in aircraft control procedures.

These are all examples of very sophisticated simulations. When writing a simulation for a micro, at least to begin with, one needs to be rather less ambitious in one's aims than to try to produce a simulation as grand as these. However, with a well-chosen subject a simulation program can grow to any length.

In this article, a simulation of a train moving round a track is developed. The simulated train moves in real time by accessing the computer's clock. Instructions can be issued interactively to the simulated system, for example to start and stop the train and to switch the points on the track. A program is first developed in BASIC. The actual development is somewhat contrived, and to demonstrate a more natural development a program is also written in COMAL. The COMAL program uses procedures to good effect and generally displays a much more direct line of development. The resulting program is much easier to understand and, therefore, to extend, adapt and amend.

Besides showing how a simulation program can be written, and displaying something of the relative merits of BASIC and COMAL, the programs that are presented here can be used as the basis of any number of projects. They can be extended in many interesting directions and can also be adapted for other simulations. The programs are written for the PET, but they can be readily adapted to run on any block graphics system. The only PET-dependent features in the BASIC program involve the clock and the screen memory. The COMAL program is written in the version of COMAL 80 that is available for the PET. This version, known as CBM COMAL 80, possesses a version of the GET statement different from that of BASIC. It seems that this GET facility is not available in all the versions of COMAL, and so even the COMAL program has one PET-dependent feature.

DISPLAY DESIGN

The screen is divided into several parts for the display as shown in Fig. 1. The track on which the train is to move is displayed in the bottom part of the screen, while the part above it is split into four parts to display the status of the simulated system and give information about the commands it can accept. These four blocks are labelled 'status', 'command status', 'command summary' and 'error messages'. The status block shows the state of the train/track system by giving the position and speed of the train, and giving the state of the points on the track. The command summary block provides a summary of the commands that can be issued so that they are always available for easy reference. The command status block shows whether the system is ready to accept a command or

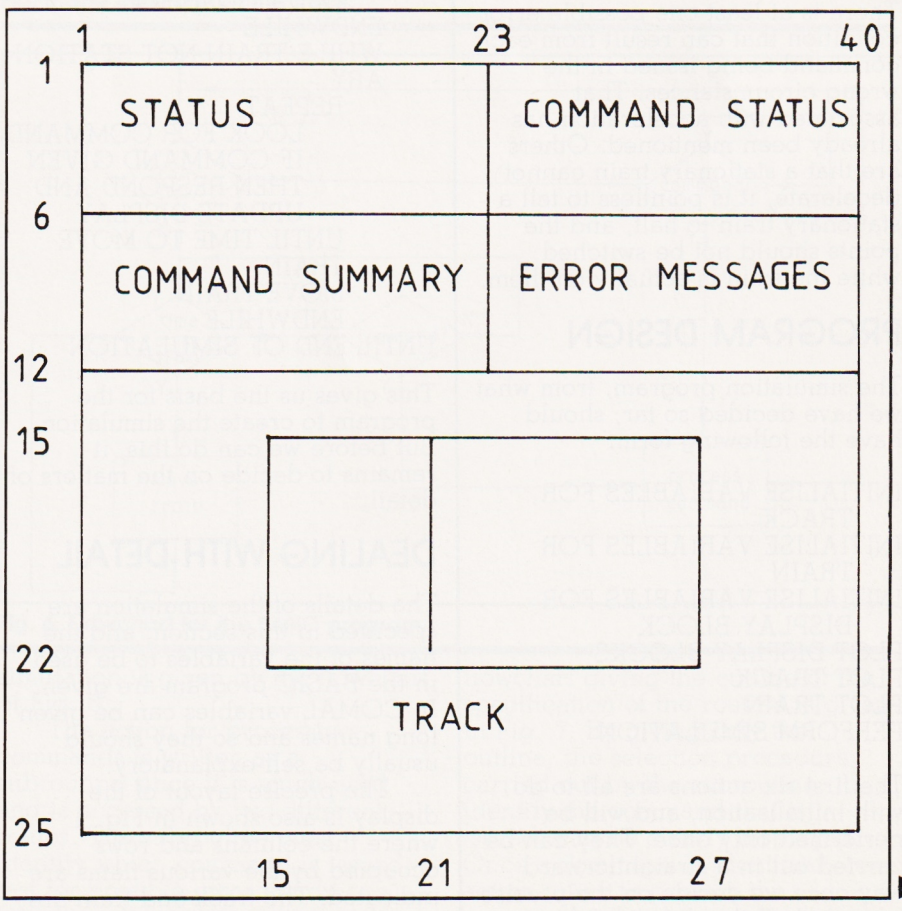

Fig. 1. Design of screen layout.

already dealing with one. The error messages block is to display any error messages resulting from inappropriate commands, such as instructing a train to accelerate when it is at top speed already.

The design chosen for the track itself is shown in Fig. 2. The train is to move clockwise around the track. Consequently the junction on the top line is a converging arrangement which can handle a train approaching on either branch, while the junction on the bottom line requires points to switch the train to either the right- or left-hand branch.

The commands are all given one letter abbreviations so that they can be issued by pressing a single key. The program implements only four commands, although it is straightforward to add more. The commands with their abbreviations and meanings are given in the following table.

Command and Abbreviation	Meaning
Accelerate (A)	Make the train accelerate. When issued to a stationary train, cause it to start.
Decelerate (D)	Make the train decelerate
Halt (H)	Make the train halt
Switch points (P)	Make the points switch over.

There is at least one possible error condition that can result from each command being issued in the wrong circumstances. That associated with acceleration has already been mentioned. Others are that a stationary train cannot decelerate, it is pointless to tell a stationary train to halt, and the points should not be switched while the train is actually on them.

PROGRAM DESIGN

The simulation program, from what we have decided so far, should have the following form:

```
INITIALISE VARIABLES FOR
    TRACK
INITIALISE VARIABLES FOR
    TRAIN
INITIALISE VARIABLES FOR
    DISPLAY BLOCK
PLOT DISPLAY BLOCKS
PLOT TRACK
PLOT TRAIN
PERFORM SIMULATION
```

The first six actions are all to do with initialisation, and will be performed only once. They can be carried out in a straightforward way once we decide on the precise form that all the details of the simulation should take. As regards the final action of performing the simulation, however, there are many matters that must be dealt with. These include moving the train, accepting commands, carrying out the commands and updating the display blocks. These matters can all be handled as shown below:

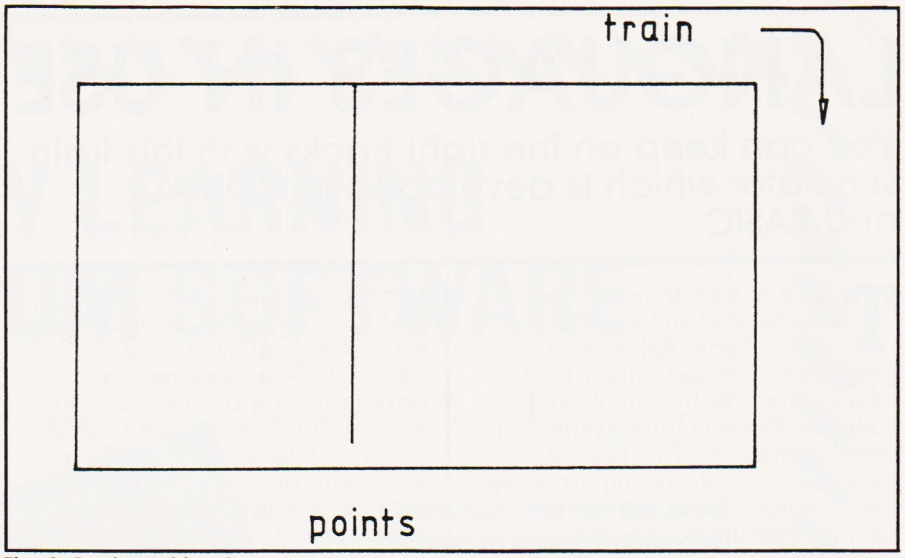

Fig. 2. Design of track.

```
REPEAT
    WHILE TRAIN STATIONARY
        LOOK FOR COMMAND
        IF COMMAND GIVEN
        THEN RESPOND AND
        UPDATE DISPLAY
    ENDWHILE
    WHILE TRAIN NOT STATION-
    ARY
        REPEAT
            LOOK FOR COMMAND
            IF COMMAND GIVEN
            THEN RESPOND AND
            UPDATE DISPLAY
        UNTIL TIME TO MOVE
        TRAIN
        MOVE TRAIN
        ENDWHILE
UNTIL END OF SIMULATION
```

This gives us the basis for the program to create the simulation. But before we can do this, it remains to decide on the matters of detail.

DEALING WITH DETAIL

The details of the simulation are specified in this section, and the names of the variables to be used in the BASIC program are given. In COMAL variables can be given long names and so they should usually be self-explanatory.

The precise layout of the display is also shown in Fig. 1 where the columns and rows occupied by the various items are indicated. The track and train are created using the graphics characters in Fig. 3. Their codes for use with POKE on the PET are also given. The character with code 254 is used to represent the train. The direction in which the points are switched is indicated as shown in Fig. 4. The track is made up of 47 block graphics characters. Their positions are labelled from 1 to 47 as indicated in Fig. 5. In the simulation each position on the track corresponds to a single-character position on the screen. By using the 47-element array AD to store the addresses of locations in the screen memory corresponding to each screen position, and the 47-element array PC to hold the codes, for use with POKE, of the characters to be placed in each screen position, the track can be plotted by:

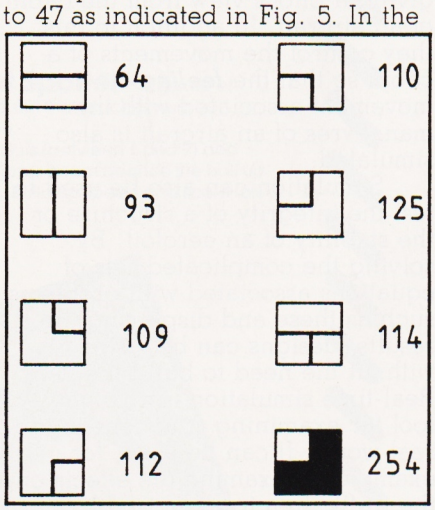

Fig. 3. Block graphics characters used for track and train.

```
FOR I=1 TO 47:POKE AD(I),PC(I):NEXT I
```

The position of the train is held in P, and so the train can be plotted by:

```
POKE AD(P),254
```

The train moves to the positions on the track in the order indicated by

the arrows in Fig. 5. This order can be recorded in a 47-element array N in which N(I) gives the next position after position I. Thus, to give a few examples, N(1) = 2, N(5) = 6 and N(47) = 6. In this way, the next position to be occupied by the train can always be computed by:

```
P=N(P)
```

The state of the points is held in PNT, with PNT = 0 representing the points switched to the left and PNT = 1 to the right. The points could be switched over by the commands:

```
IF PNT=0 THEN PNT=1
IF PNT=1 THEN PNT=0
```

However, the single simple command:

```
PNT=1-PNT
```

has the same effect and is much more compact. Similarly, the next position after the points can be changed by:

```
IF PNT=0 THEN N(28)=29
IF PNT=1 THEN N(28)=41
```

or by:

```
N(28)=29+12*PNT
```

The train speed is held in SP. A stationary train is represented by SP = 0, and there are four different speeds represented by values of 1 to 4 with SP = 4 representing the top speed. The commands for acceleration and deceleration cause the speed to be increased or decreased by one when that is possible. The halt command causes SP to be set to zero. The speed at which the train moves is simulated by holding the train in a track position for a fixed length of time. These time delays are held in the array TD, so that at speed SP the relevant time delay is held in TD(SP). It is given as a number of 'jiffies' (sixtieths of a second), which is the time unit of the PET's clock.

THE BASIC PROGRAM

The part of the program for the initialisation stages can now be written in a straightforward way. It is lines 10 to 720 in Listing 1.

The simulation part of the program cannot be written easily with reference to the rather natural specification given already, since BASIC does not support repetitions controlled by WHILE and UNTIL. To provide a framework for writing the BASIC program a specification expressed in terms of simple conditions is more appropriate, relating as it does to the IF — THEN statement of BASIC. An appropriate description of the simulation is given by the flowchart of Fig. 6.

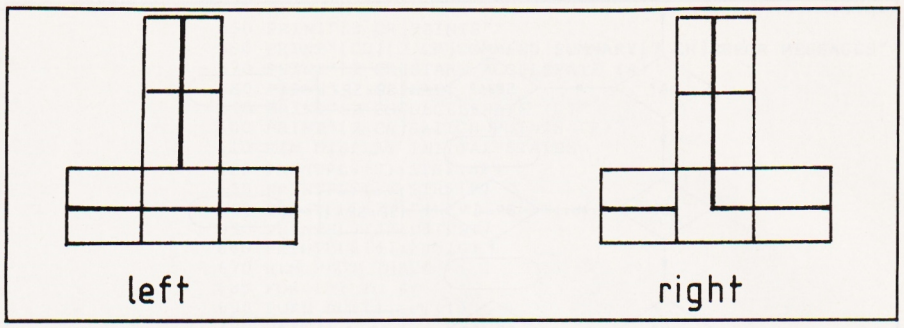

Fig. 4. Representation of points.

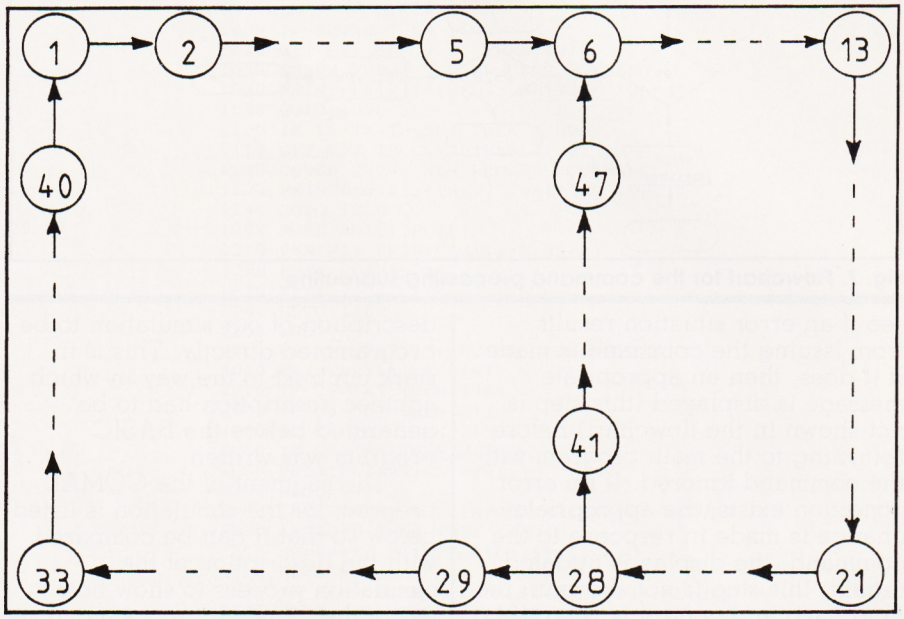

Fig. 5. The positions on the track.

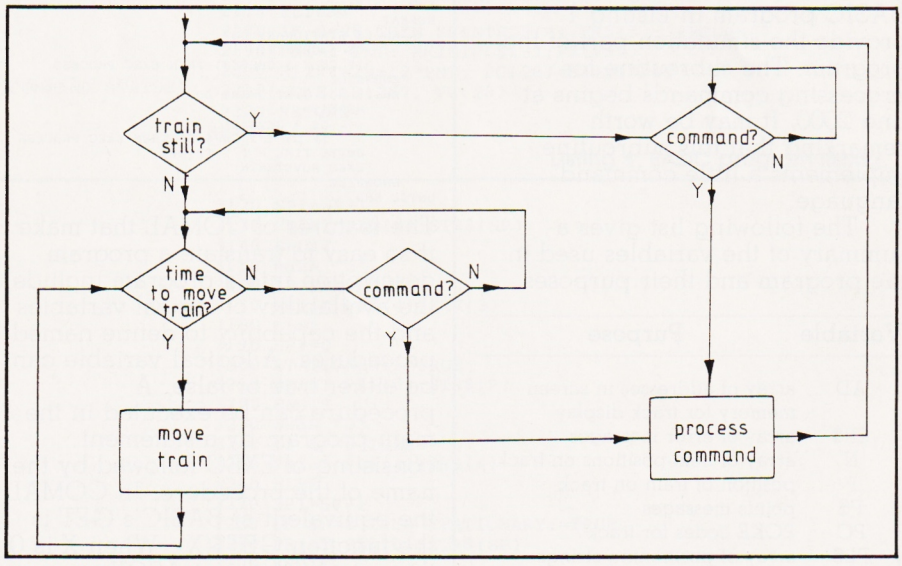

Fig. 6. Flowchart for the BASIC program.

The action for processing commands is written as a subroutine since it is much used and is accessed by two different routes. The subroutine must identify which command is issued, test for possible error conditions, take the appropriate action and update the display accordingly. A flowchart giving the outline of the specification of the routine is given in Fig. 7. By giving only the outline, the selection procedure carried out by the subroutine, to identify the command that is issued, can be clearly displayed. Once a command is identified, the action taken to process the command is fundamentally the same in each case. First a test to ▶

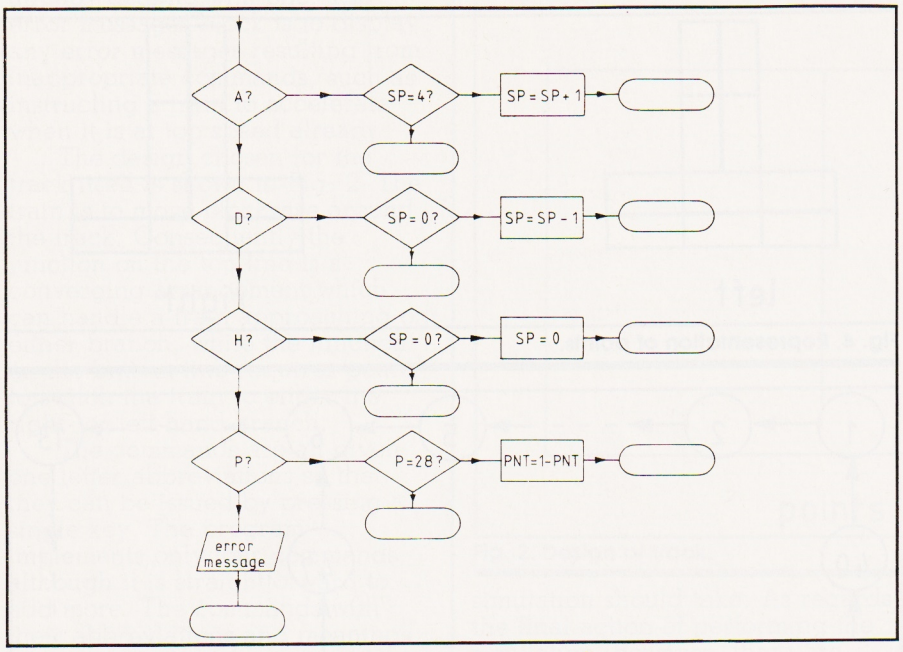

Fig. 7. Flowchart for the command processing subroutine.

see if an error situation results from issuing the command is made. If it does, then an appropriate message is displayed (this step is not shown in the flowchart) before returning to the main program with the command ignored. If no error condition exists, the appropriate change is made in response to the command, the display is updated (again, this step is not shown in the flowchart) and control is returned to the main program.

Lines 1000 to 1240 of the BASIC program in Listing 1 provide the simulation part of the program. The subroutine for processing commands begins at line 2000. It may be worth remarking that this subroutine implements a little command language.

The following list gives a summary of the variables used in the program and their purposes.

Variable	Purpose
AD	array of addresses in screen memory for track display
ER$	array of error messages
N	array of next-positions on track
P	position of train on track
P$	points messages
PC	POKE codes for track
PL$	array of positioning strings
PNT	state of points
SP	speed of train
T	time at start of timing period
TD	array of time delays for movement
TI	time on system clock

COMAL

COMAL is chosen here as the language for writing an alternative version of the simulation program because it permits the first description of our simulation to be programmed directly. This is in stark contrast to the way in which another description had to be generated before the BASIC program was written.

The segment of the COMAL program for the simulation is listed below so that it can be compared with the description of the simulation process to show how easily the COMAL program can be generated from the description:

```
STATIONARY := TRUE
END := FALSE
REPEAT
    WHILE STATIONARY DO
        C$ := GET$(0)
        IF C$ <> CHR$(0) THEN EXEC PROCESS
    ENDWHILE
    WHILE NOT STATIONARY DO
        REPEAT
            C$ := GET$(0)
            IF C$ <> CHR$(0) THEN EXEC PROCESS
        UNTIL TIME - T > TD(SP)
        EXEC MOVETRAIN
    ENDWHILE
UNTIL END
```

The features of COMAL that make it so easy to translate a program description into a program include the availability of logical variables and the capability to define named procedures. A logical variable can be either true or false. A procedure can be executed in the main program by a statement consisting of EXEC followed by the name of the procedure. In COMAL the equivalent of BASIC's GET is the function GET$(X). When X is 0 this returns the next ASCII character from the keyboard. If no key is pressed the NULL character (with ASCII code zero) is returned.

The part of the COMAL program for the simulation, including the procedures PROCESS and MOVETRAIN, is listed in Listing 2. The part of the program for the initialisation stages is not listed as it is very similar to the corresponding part of the BASIC program. Where a variable serves the same purpose in the COMAL program as in the BASIC program it is given the same name. In this way the COMAL program listing maintains a parallel with the BASIC program. This does mean that COMAL is not shown to full advantage, since its long variable names can make programs readable and the purpose of a variable readily apparent. One exception is that the PET's clock is accessed from BASIC by the variable TI, but from COMAL by the variable TIME.

The procedure for processing the commands is written using a CASE statement to determine which command is issued rather than the sequence of IF — THEN statements in the BASIC program. This is because the CASE statement of COMAL permits the use of a character variable as a selector. The use of CASE and IF — THEN — ELSE statements gives a procedure with a single exit point, in contrast to the BASIC subroutine which has numerous exits.

CONCLUSIONS

There is plenty of scope for further developing the programs presented here. One obvious addition would be to include provision for reversing the train. A second is to extend the program to handle more than one train.

The following remarks can be made on the languages used. Before a program can be written for a task, it must be specified in some way. A natural way to specify a task is to give its description in careful English. This article gives one illustration that BASIC is not an entirely suitable language for creating programs from such natural descriptions, whereas COMAL is. BASIC does not possess the programming structures corresponding to the features of a natural description. This makes it necessary to generate a contrived description of the task that is matched to the features that BASIC ***does*** possess before a directly corresponding BASIC program can be written. In contrast, COMAL has all the necessary programming structures for a natural description to be converted line by line into a COMAL program.

A program developed from a clear and careful description to which it is directly related will be easy to correct, understand and modify. A program that is developed in an indirect way because of the shortcomings of the language it is written in can claim none of these properties.

```
10 DIM N(47),PC(47),AD(47),TD(4)
20 DIM ER$(5),PL$(4),P$(1)
30 REM***INITIALISATION OF VARIABLES***
40 REM VARIABLES FOR TRACK
50 FOR I=1 TO 46
60 N(I)=I+1
70 NEXT I
80 N(40)=1: N(47)=6
90 PNT=0
100 FOR I=2 TO 12
110 PC(I)=64:AD(I)=33341+I
120 J=34-I
130 PC(J)=64:AD(J)=33661+I
140 NEXT I
150 PC(6)=114
160 FOR I=1 TO 7
170 J=13+I
180 PC(J)=93:AD(J)=33354+40*I
190 K=41-I
200 PC(K)=93:AD(K)=33342+40*I
210 L=48-I
220 PC(L)=93:AD(L)=33347+40*I
230 NEXT I
240 PC(1)=112: AD(1)=33342
250 PC(13)=110: AD(13)=33354
260 PC(21)=125: AD(21)=33674
270 PC(33)=109: AD(33)=33662
280 REM VARIABLES FOR TRAIN
290 SP=0: P=1
300 TD(1)=100:TD(2)=65:TD(3)=40:TD(4)=25
310 REM MESSAGES
320 ER$(0)="[15 SPC]"
325 ER$(1)="[2 SPC]NOT A COMMAND"
330 ER$(2)="TOP SPEED -NO A"
335 ER$(3)="[2 SPC]HALTED NOW(H)"
340 ER$(4)="HALTED NOW-NO D"
345 ER$(5)="TRAIN ON POINTS"
350 P$(0)=" LEFT":P$(1)="RIGHT"
360 REM POSITIONING STRINGS
370 PL$(0)="[HOM][2 CD][18 CR]"
380 PL$(1)="[HOM][3 CD][18 CR][2 SPC][3 CL]"
390 PL$(2)="[HOM][3 CD][26 CR]"
395 PL$(3)="[HOM][4 CD][12 CR]"
400 PL$(4)="[HOM][8 CD][24 CR]"
410 REM *** CREATE DISPLAY ***
420 REM PLOT STATUS BLOCKS
425 PRINT"[CLS]"
430 FOR I=32768 TO 32807
440 POKE I,160:POKE I+200,160
450 POKE I+440,160
460 NEXT I
470 FOR J=1 TO 10
480 POKE 32768+40*J,160
490 POKE 32790+40*J,160
500 POKE 32807+40*J,160
510 NEXT J
520 PRINT"[HOM][CD][2 CR]STATUS[16 CR]COMMAND STATUS"
530 PRINT"[3 CR]TRAIN SPEED"
540 PRINT"[3 CR]TRAIN POSITION"
550 PRINT"[3 CR]POINTS"
560 PRINT"[CD][2 CR]COMMAND SUMMARY[7 CR]ERROR MESSAGES"
570 PRINT"[2 CR]START,ACCELERATE (A)
580 PRINT"[2 CR]HALT (H)"
590 PRINT"[2 CR]DECELERATE (D)"
600 PRINT"[2 CR]SWITCH POINTS (P)"
610 REM DISPLAY INITIAL STATUS
620 PRINTPL$(0);STR$(SP)
630 PRINTPL$(1);STR$(P)
640 PRINTPL$(2);"[REV]  WAITING [OFF]"
650 PRINTPL$(3);P$(PNT)
660 PRINTPL$(4);ER$(0)
670 REM PLOT TRACK
680 FOR I=1 TO 47
690 POKE AD(I), PC(I)
700 NEXT I
710 REM PLOT TRAIN
720 POKE AD(P), 254
999 REM ***  SIMULATION ***
1000 IF SP<>0 THEN 1100
1010 GET C$: IF C$="" THEN 1010
1020 GOSUB 2000: REM PROCESS COMMAND
1030 PRINTPL$(2);"[REV]  WAITING [OFF]"
1040 GOTO 1000
1100 IF TI-T>=TD(SP) THEN 1200
1110 GET C$: IF C$=""THEN 1100
1120 GOSUB 2000: REM PROCESS COMMAND
1130 PRINTPL$(2);"[REV]  WAITING [OFF]"
1140 GOTO 1000
1200 POKE AD(P),PC(P)
1210 P=N(P): PRINTPL$(1);STR$(P)
1220 POKE AD(P),254
1230 T=TI
1240 GOTO 1100
1250 END
2000 PRINTPL$(2);"[REV]PROCESSING[OFF]"
2010 PRINTPL$(4);ER$(0)
2020 IF C$="A" THEN 2080
2030 IF C$="H" THEN 2120
2040 IF C$="D" THEN 2150
2050 IF C$="P" THEN 2180
2060 PRINTPL$(4);C$;ER$(1)
2070 RETURN
2080 IF SP=4 THEN PRINTPL$(4);ER$(2):RETURN
2090 IF SP=0 THEN T=TI
2100 SP=SP+1: PRINTPL$(0);STR$(SP)
2110 RETURN
2120 IF SP=0 THEN PRINTPL$(4);ER$(3):RETURN
2130 SP=0: PRINTPL$(0);STR$(SP)
2140 RETURN
2150 IF SP=0 THEN PRINTPL$(4);ER$(4): RETURN
2160 SP=SP-1: PRINTPL$(0);STR$(SP)
2170 RETURN
2180 IF P=28 THEN PRINTPL$(4);ER$(5): RETURN
2190 PNT=1-PNT: PRINTPL$(3);P$(PNT)
2200 N(28)=29+12*PNT: PC(28)=64+45*PNT
2210 POKE AD(28), PC(28)
2220 RETURN
READY.
```

Listing 1. BASIC program listing.

```
2000 STATIONARY:=TRUE
2010 END:=FALSE
2020 REPEAT
2030 WHILE STATIONARY DO
2040 C$:=GET$(0)
2050 IF C$<>CHR$(0) THEN EXEC PROCESS
2060 ENDWHILE
2070 WHILE NOT STATIONARY DO
2080 REPEAT
2090 C$:=GET$(0)
2100 IF C$<>CHR$(0) THEN EXEC PROCESS
2110 UNTIL TIME-T>TD(SP)
2120 EXEC MOVETRAIN
2130 ENDWHILE
2140 UNTIL END
2500 PROC MOVETRAIN
2510 POKE AD(P), PC(P)
2520 P:=N(P)
2530 PRINT PL$(1);STR$(P)
2540 POKE AD(P), 254
2550 T:=TIME
2560 ENDPROC
3000 PROC PROCESS
3010 PRINT PL$(2);"[REV]PROCESSING[OFF]"
3020 PRINT PL$(4);ER$(0)
3030 CASE C$ OF
3040 WHEN "A"
3050 IF SP=4 THEN
3060 PRINT PL$(4);ER$(2)
3070 ELSE
3080 IF SP=0 THEN
3090 T:=TIME
3100 STATIONARY:=FALSE
3110 ENDIF
3120 SP:=SP+1
3130 PRINT PL$(0);STR$(SP)
3140 ENDIF
3150 WHEN "H"
3160 IF SP=0 THEN
3170 PRINT PL$(4);ER$(3)
3180 ELSE
3190 SP:=0
3200 STATIONARY:=TRUE
3210 PRINT PL$(0);STR$(P)
3220 ENDIF
3230 WHEN "D"
3240 IF SP=0 THEN
3250 PRINT PL$(4);ER$(4)
3260 ELSE
3270 SP:=SP-1
3280 IF SP=0 THEN STATIONARY:=TRUE
3290 PRINT PL$(0);STR$(SP)
3300 ENDIF
3310 WHEN "P"
3320 IF P=28 THEN
3330 PRINT PL$(4);ER$(5)
3340 ELSE
3350 PNT:=1-PNT
3360 PRINT PL$(3);P$(PNT)
3370 N(28):=29+12*PNT
3380 PC(28):=64+45*PNT
3390 POKE AD(28), PC(28)
3400 ENDIF
3410 OTHERWISE
3420 PRINT PL$(4);C$;ER$(1)
3430 ENDCASE
3440 ENDPROC
```

Listing 2. COMAL program listing.

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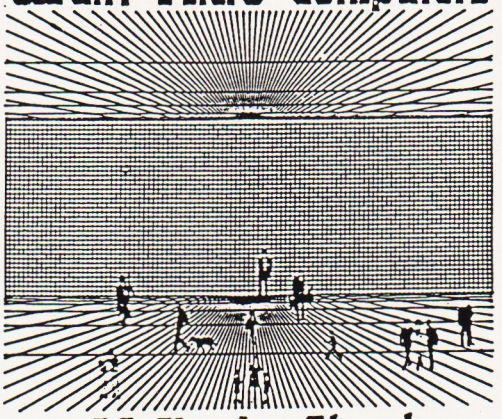

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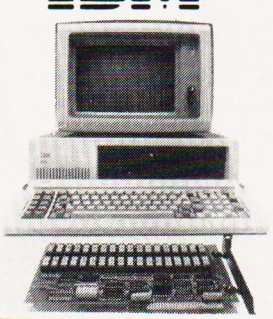

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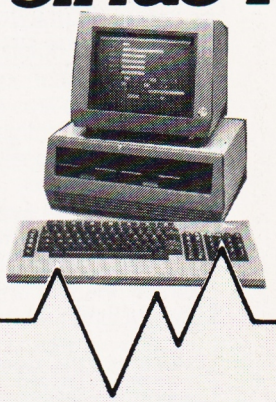

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PROBLEM PAGE

A solution, a problem, and a discussion on the inability of computers to use insight.

The emphasis on prime numbers last month should have provided a fairly broad clue to the solution of the problem propounded. The members of the club paid up a total of £2088.60, and if the secretary had contributed the extra penny towards his own present the total would have been £2088.61. Even without the hint, experienced problem-solvers would guess that 208861 was the product of two prime numbers, one less than 400 (the subscription plus 1p) and the other greater than 400 (the number of members). The problem then involves discovering the factors (331 and 631).

The program in Listing 1 is convenient for this purpose, but the lengthy data statements are less convenient. If you used the program given last month to create an array full of primes, that can be used in place of the data. No more than the first 180 primes will serve for factorising numbers up to a million.

The computer can thus be made to do the donkey work, but the method has to be decided first. Nor is the result of factorisation the final answer to the question posed, which asked how much was available to spend on the present. That will be the larger of the two factors, less one. It would have been possible to extend the program to provide that as the result, but the program would then become specialised, rather than of more general utility. As it stands, it could equally well be used to solve:

'A hundred campers ran short of food, and some of them went out to forage among the local farms. Each brought back the same number of eggs, the total number of eggs being 5459. How many campers stayed behind in camp?'

```
100 CLS
110 DIM M(20)
120 INPUT A
130 RESTORE
140 LET X=A
150 LET M=1
160 FOR N=1 TO 79
170 READ D
180 LET P=X/D
190 IF P<>INT (P) THEN GO TO 240
200 LET M(M)=D
210 LET M=M+1
220 LET X=P
230 GO TO 180
240 NEXT N
250 IF X<>1 THEN LET M(M)=X: LET M=M+1
260 PRINT "The factors of ";A;" are;"
270 FOR N=1 TO M-1
280 PRINT M(N);
290 IF N<>M-1 THEN PRINT " x ";
300 NEXT N: PRINT
310 GO TO 120
320 DATA 2,3,5,7,11,13,17,19,23,29
330 DATA 31,37,41,43,47,53,59,61,67
340 DATA 71,73,79,83,89,97,101,103
350 DATA 107,109,113,127,131,137,139
360 DATA 149,151,157,163,167,173,179
370 DATA 181,191,193,197,199,211,223
380 DATA 227,229,233,239,241,251,257
390 DATA 263,269,271,277,281,283,293
400 DATA 307,311,313,317,331,337,347
410 DATA 349,353,359,367,373,379,383
420 DATA 389,397,401
```

Listing 1.

Here, we run into a typical hidden snag. The computer can factorise 5459 and subtract the lesser factor from 100, but the answer could still be wrong, since nothing was said about *all* the rest of the campers staying in camp. Similarly, a different answer to the club problem could be worked out on the basis that the subscription involved an odd ½p. Subtleties like that are hard enough to detect in manual working, but the computer – being ignorant of the tortuous workings of the human mind – could only pick them out if it was programmed to do so.

Another area in which the computer relies on outside help centres around the significance of the particular numbers used in a problem. For example:

'A store held in stock 1386 Abdabs, 1092 Booboos, 1001 Clangers, and 1716 Doodads. The price of each item was a whole number of pence, not exceeding 10. What were these prices, if the overall value was £397.42?'

The four quantities are the key to the matter. If you examine them carefully, you may see how to program the computer to work out most of the solution. A suggested program will be given next month.

COMPUTER LIMITATIONS

Meanwhile, it will be interesting to consider some of the types of problem that are outside the scope of computer capabilities. One problem that has been a source of annoyance for years is about a series of roads fanning out from a given point, and intersected by two other roads. The solution blithely states that the roads form a 'harmonic pencil', on which basis the solution is simple. For those who have never heard of a harmonic pencil the problem is virtually insoluble, and the computer is in the same situation.

Some problems can be solved, in a rather laborious manner, by trying various combinations of variables in turn. This can be done by setting up a series of nested FOR loops, with the key calculation in the middle, but that approach is slow, and may not be completely valid unless coincidental values are ruled out.

A better approach may be to use the methods which have been developed over many centuries by campanologists (bellringers, for those without dictionaries). This essentially entails a series of exchanges. For a three-element set the changes might be as shown in Fig. 1. When C comes 'home' to its original position, the sequence is complete. On the other hand, with four elements the sequence is shown in Fig. 2. D has come home, but the sequence repeats after only eight of the 24 possible combinations. A variation is required, and this is obtained by exchanging only the right-hand pair, which sets up the next eight changes (see Fig. 3). The variation is repeated to give the final eight.

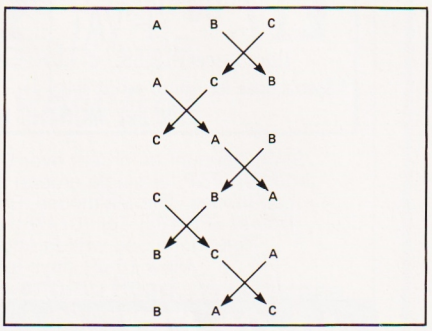


Fig. 1. Exchanging pairs of elements gives all possible combinations.

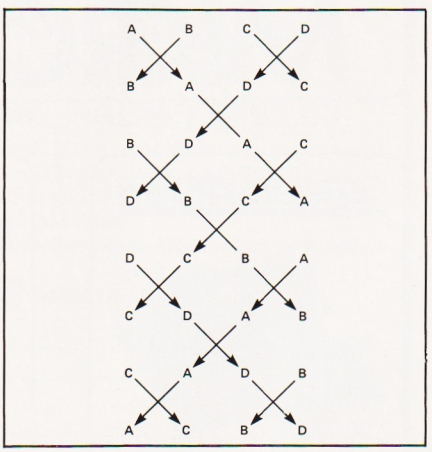


Fig. 2. After one set of changes, a four-element set has used only eight possible combinations.

The method can be extended to more elements, but unfortunately it seems to be impossible to obtain a manual on the more complex methods, though there are no doubt well-thumbed

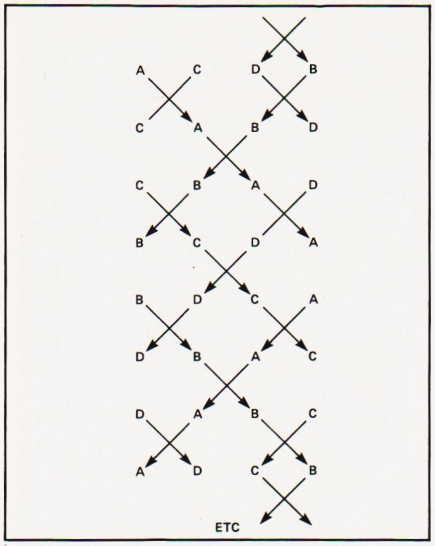


Fig. 3. An asymmetric change gives a second set of eight: repeating this gives the final eight.

copies in remote vicarages where the sound of bells is still tolerated. Otherwise, this type of routine would be useful for certain types of program.

THE INSIGHT STORY

Geometrical problems, which are often based on an obscure Euclidean rule or a subtle fiddle, are likely to beat both the computer and its programmer. There is the classic about a cylindrical hole, 6" long, through a sphere, which leaves a volume surrounding it that is the same, whatever the size of the sphere. To discover this fact, you need to perform some complex calculus, and if you neither know the fact already nor can work out the mathematics the computer will be unable to help. On the other hand, you scarcely need a computer to work out the volume of a sphere which has a diameter equal to the length of the cylindrical hole, which is the trick of insight required for a simple calculation of the constant volume (Fig. 4).

The truth is that computers still have 'blind spots' in which they can look extremely inept, even if those who program them are able and willing to minimise the limitations. It must always be remembered that the inside of a computer can be isolated from the outside world, and thus is entirely dependent on the facts it contains.

It has been postulated that genuinely intelligent computers will never exist until a method can be devised for making them ask spontaneous relevant questions. The ability to ask pre-arranged questions is not enough, since the programmer might have forgotten something. Unfortunately, it has also been postulated that in order to be able to ask intelligent questions spontaneously a computer must first be intelligent, which creates a chicken and egg situation.

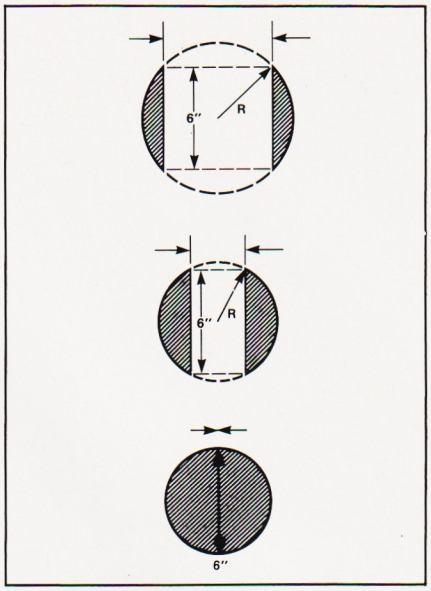
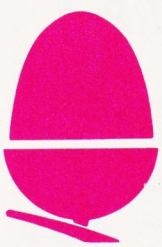


Fig. 4. The hole through the sphere is 6" long. Insight tells us that if the hole has zero width, the volume left is the volume of the sphere. A computer cannot use insight.

Until a way is found to break this deadlock, we will have to continue to think out in advance the questions which a computer needs to solve a given problem.



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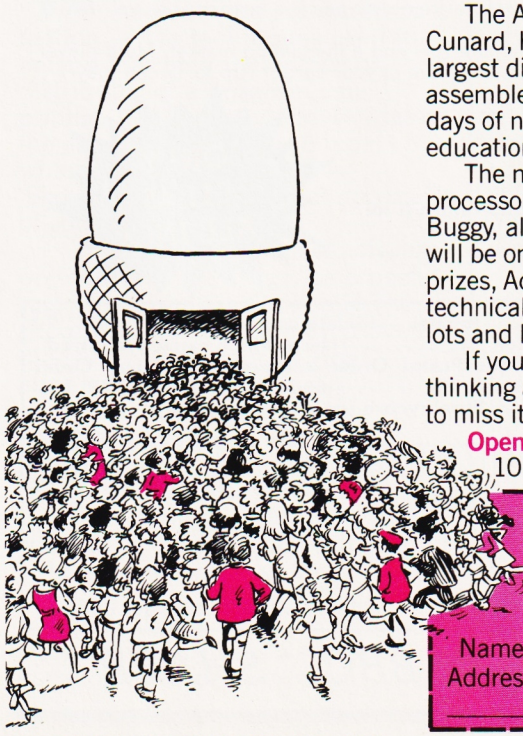

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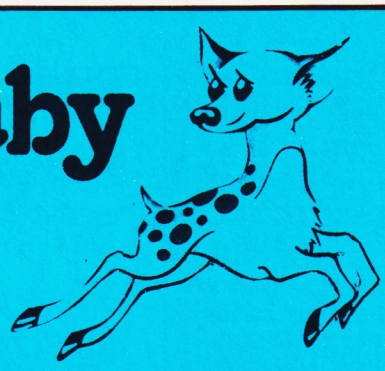

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Simon Goodwin

SOFTWARE PROTECTION

Avast there, me hearties — there's a vast swindle going on. Is the industry fighting a losing battle against the pirates?

Whatever your interest in computing you've probably encountered software protection — the techniques used to ensure that only the author or distributor of a program can publish it. This article investigates the schemes, digital and legal, which set out to prevent 'bootlegging' — the illicit copying of software.

There are two aims of software protection. First, it can be a useful way of preventing duplication of programs. Second, it may prevent the owner of a program from altering it. Publishers are especially worried that minor changes might be made to a program, and then it could be sold in competition with the original. Software publishers become very worried when they realise that most of the people who use their programs never paid for the privilege. Once a micro has become established it is quite common for user-groups and groups of friends to copy original tapes or discs repeatedly. Even in the 'good old days' of mainframe and mini computers programs were often copied unofficially, but this posed little threat to software writers. Users were few and far between, so it was unlikely that a program would travel far. Much software was tailor-made, and of little use to those outside the firm which paid for it.

The microcomputer software market is very different. Programs are general-purpose, and users abound. This has led to a new facet of the computer trade — Software Piracy.

THE SCALE

One PET software house closed down cassette sales two years ago, claiming that there were 10 'bootleg' (unpaid) copies of their programs in existence for every one copy which was paid for. Other publishers have commented that sales drop off sharply about six months after a program is released — by then almost all of the potential buyers know someone who will make them a copy. There is little incentive to buy the program from the distributor.

To some extent the notion of a 10-to-one ratio of bootlegs to legitimate copies is misleading. Many people will take a copy of a program which they would not consider buying. Even so, there can be no doubt that software publishers are losing millions of pounds a year at the expense of those who copy rather than buy.

The most blatant brand of bootlegging was in evidence at the 1982 PCW show. A visitor was seen to be roving the stands, miniature tape-recorder in hand, interrupting and copying the programs from demonstration computers. The layout of the stands — with unattended desks projecting towards the passages — meant that the bootlegger could take copies under ▶

cover of the crowds pressing toward the sales-staff at the other end of the desks. Of course, most people who copy programs without permission are a little more subtle than that.

The size of the bootlegging problem does not seem to be the result of large-scale copying by a few individuals. Letters to American magazines such as Byte and 80 Micro have revealed that most computer users, whether hobbyists or professionals, regularly copy programs which they did not purchase. Contact with individuals, clubs and even shops in the UK confirms that this practice is not confined to America!

Predictably this issue is a very controversial one. Software publishers argue that their market is being restricted, and that those who write programs are not receiving a just reward for their efforts. Certainly there are a few hobbyists who have libraries of software worth hundreds of pounds, yet they never paid a penny for any of it. Interestingly, many of the most 'valuable' items in their collections often turn out to be business or utility programs which they rarely, if ever, use! Often the bootlegger has little or no documentation for the program — it was copied on the off-chance that it might come in useful.

THE LAW

The duplication of programs is probably illegal, since most programs are now sold on the condition that the purchaser does not make a copy. There is no explicit law which says that programs can be copyrighted in the same manner as books or records. The Copyright Act was passed in 1956, when computer systems were still described in the press as 'Electronic Brains' and there were only a few hundred machines throughout the country. The Act does not mention computers at all.

Some firms argue that programs are 'literary work', and hence that existing law protects them. Legal judgements have differed about this principle. Three years ago someone started to sell the 'Micro Ace' — a computer with a ROM program almost identical to that of Sinclair's ZX80. Understandably Sinclair took the competitor to court, saying that the copy was illegal. The judge threw out the claim, saying, in principle, that he could not 'read' the ROM and consequently it could not be copyrighted. The Copyright Act says that any document may be 'used' by someone who does not hold the copyright, so long as it is not 'reproduced in any material form'.

Sinclair eventually showed that the physical design of the keyboard of the Micro Ace duplicated that the ZX80. That duplication was said to be a breach of Sinclair's mechanical patent. The case was eventually settled out of court, and it seems that Sinclair came off better.

A few years ago 'The Softwarehouse' was able to stop a competitor selling copies of a game. The program was called 'Android Nim', and it featured bleeping and buzzing noises as animated robots moved around the screen. A court agreed that the sounds were 'music' in the eyes of the law, and the competitor was forced to stop selling the game, since music can be made copyright without problems.

Another case was brought by a firm called Molimerx (they claim to be named after the Roman word for software, since the Latin word 'molis' means 'soft' and 'merx' means 'ware'!). Molimerx published an American program called 'Level 3 BASIC' for the TRS-80. Kansas City Systems, another TRS-80 firm, started to sell 'Level 4 BASIC' — a program which more or less duplicated the facilities of 'Level 3', with a few extra options and at least one extra bug!

Kansas claimed that they had legitimately bought the program, but Molimerx demonstrated that most of 'Level 4' program was identical to their 'Level 3', which came first. Kansas City Systems were forced to stop selling 'Level 4'.

TAKING PRECEDENCE

There have been other claims of software stealing, but there is still no clear legislation over computer copyright. Part of the problem is the vast cost of setting a legal precedent. At the time of writing no one has been found guilty of explicitly breaching copyright over software — firms have settled out of court rather than fight a protracted battle

to establish the principle of software copyright. Such a battle would be drawn-out and very expensive for both sides. (Indeed, our own ASP software has had three disputes over The Valley. Two of these were settled out of court, the third is still in progress — Ed.).

Even if copyright law does cover computer programs, it only protects the code, and not the design. Technically any text becomes copyright as soon as it is written, so long as it is 'the original expression of an idea'. There is no need to 'register' the text or to post it to yourself, although that can be useful if you need to prove when you wrote something. The problem is that copyright only protects the words you use, and not their meaning — others can express the same idea in a slightly different way with impunity. You can't stop people copying the ideas in a program by saying that the rules of a game or the facilities of a business package are copyright.

If copyright protection is not available then there are still other ways in which a program may be legally protected. Some software houses sell programs under a contract which forbids copying — if the buyer agrees to the contract then the software house is entitled to take legal action if the program is duplicated without permission.

If a new machine or a new industrial process is discovered then it is possible for the inventor to take out a patent. The design is registered and published. If it turns out to be original then the inventor can demand payment from anyone who uses the design. Some firms have tried to patent computer programs, although they have not had much success. Patent law is designed to protect traditional inventors, who have new ideas for gadgets like biros, faster-than-light engines or danger-sensitive sunglasses. It takes a long time — about two years — for a patent to be approved, and it costs thousands of pounds. The 1977 Patent Act explicitly says that you can't patent a computer program, but some lawyers argue, confusingly, that you can still patent a gadget than incorporates a computer program, so long as the program is not the only novel part of the device. Unfortunately very few computer programs are original — most programming ideas are simply refinements of previous programs.

Another way to stop people copying a program is to use trade marks. If you think of an original word or phrase you can register it, so that others will need your permission before they use it. In this way the Japanese firm Taito was able to stop other people from calling their games 'Space Invaders', since they registered the phrase as a trade mark. Of course, that didn't stop people producing programs called 'Space Intruders', 'Earth Invaders', 'Star Invaders' and a galaxy of other sound-alike names. It is easier to register a trade mark than a patent, but it still takes a while and you have to pay for a 'search' to ensure that your word or phrase is not already in common use.

SOFTWARE PROTECTION

As arguments over the law ramble on, publishers and programmers have invested large amounts of effort into 'software protection' — tricks designed to make it difficult for users or dishonest dealers to copy programs without permission. Publishers, though, are hampered by the fact that it must still be possible for legitimate users to load and run the programs, so that those who would wish to copy them always have a starting point from which to 'crack' the protection scheme. Unfortunately, avoiding protection is rather an enjoyable occupation, especially to anyone with an interest in logic and programming.

There is no mechanical way to stop people from duplicating taped programs. That is obvious from the state of the record market, where stickers claiming that 'Home Taping is Killing Music' proliferate. The fact of the matter is that there is no feasible way that record companies can stop people from casually taping music. Their only practical action is to sue people who try to make a profit at their expense by issuing 'bootleg' records — illegal copies. Of course in the software market it is not yet certain that such copies are illegal, although past experience would suggest that they are.

The last people to publicise a mechanical technique for preventing copying were the Beatles' Apple record company. More than a decade ago they claimed that they could stop the copying of records. Apparently their system would work by recording an inaudible ultrasonic whistle on a record. This whistle would interfere with the ultrasonic 'bias' tone of a tape-recorder, producing a 'beat' frequency in the audible range to make copying impossible. Unfortunately the technique is easy to evade (you just filter out the whistle!), and it was never used commercially. ***Any*** signal that can be added inaudibly to a record can simply be removed without harm to the music. A similar principle holds with computer-tapes.

The most reliable way to copy computer programs is with the aid of

a computer. Programs are saved as a pattern of 'clicks' on the tape. The timing of the clicks reflects the information stored. Unfortunately almost all computers assign different meanings to the timings, which is why it is usually not possible to load tapes for one brand of computer onto another.

A simple method of software duplication is 'dubbing' — recording the sound from one recorder onto another. Normally the recorders must be directly connected for this to work — a microphone and loudspeaker introduce too much distortion, and computer-tapes are quite exacting. Up to a certain level of interference they will reject misleading signals, but beyond that point a tape usually becomes completely unreadable. One extra click on a computer recording can make nonsense of everything that follows. There is consequently a definite limit to the number of times a computer program can be dubbed before the copy becomes unreadable. At each stage the existing hum and noise on the tape is duplicated, and distortion is added. The number of 'generations' of copying possible varies depending upon the type of computer and the machinery used to make the copy, but a third or fourth generation dub of a program is usually useless. However, there is an alternative to tape-to-tape dubbing.

Once the tape-recording pattern or 'protocol' of a machine is known it is generally quite simple to imitate it, using a machine-code routine which will load absolutely any file which the computer can recognise, one bit at a time, storing the details in memory. Normally files contain 'control information', which specifies where they should be stored, whether they are BASIC or machine-code, and other details. All of this information is ignored by the bootleg loader, which just reads the tape, storing each bit, until the end of the file is reached. The control information has been ignored, so that the program being copied has had no chance to take over the system. Once the entire file has been loaded it may be written out exactly as it was read. This form of 'digital copying' has the advantage that the copy is as good as the original. All the hiss and crackle is filtered out when the tape is loaded, so that the copy is in 'first generation' form — straight from the computer.

If the 'original' was itself a second generation copy, the new version may actually be better quality. This technique is the most reliable way to duplicate programs — and it is the only way to copy discs, since it is not possible to directly connect two disc drives and dub between them.

The software protection of disc programs is a fascinating and technical issue. In principle, a disc drive works just like a tape, recording clicks onto magnetic material. Programs are recorded in the form of circular (not spiral) 'tracks' on a disc of magnetic material. The disc is spun whenever the computer tries to read it. The computer is able to move a 'head', similar to the cartridge of a record player, so that the head hangs above any track. Once the head is positioned it is able to pick up the clicks recorded on the track.

Disc software protection involves devious things like missing out tracks or putting them in places where they aren't expected. Discs are normally divided into 'sectors', like slices of cake. Special 'formatting' clicks on the disc mark the start and end of sectors. Protected discs often have missing or oddly-spaced sectors. It is conventional for tracks and sectors to be numbered — protected discs often use odd numbering schemes.

The aim is to stop the copier from working out where the data starts and finishes. The most devious disc-copying programs take a long time to run, since they must make a very exact copy, duplicating everything that could possibly be data, however odd its form, and making sure that the relationship between all of the clicks is maintained.

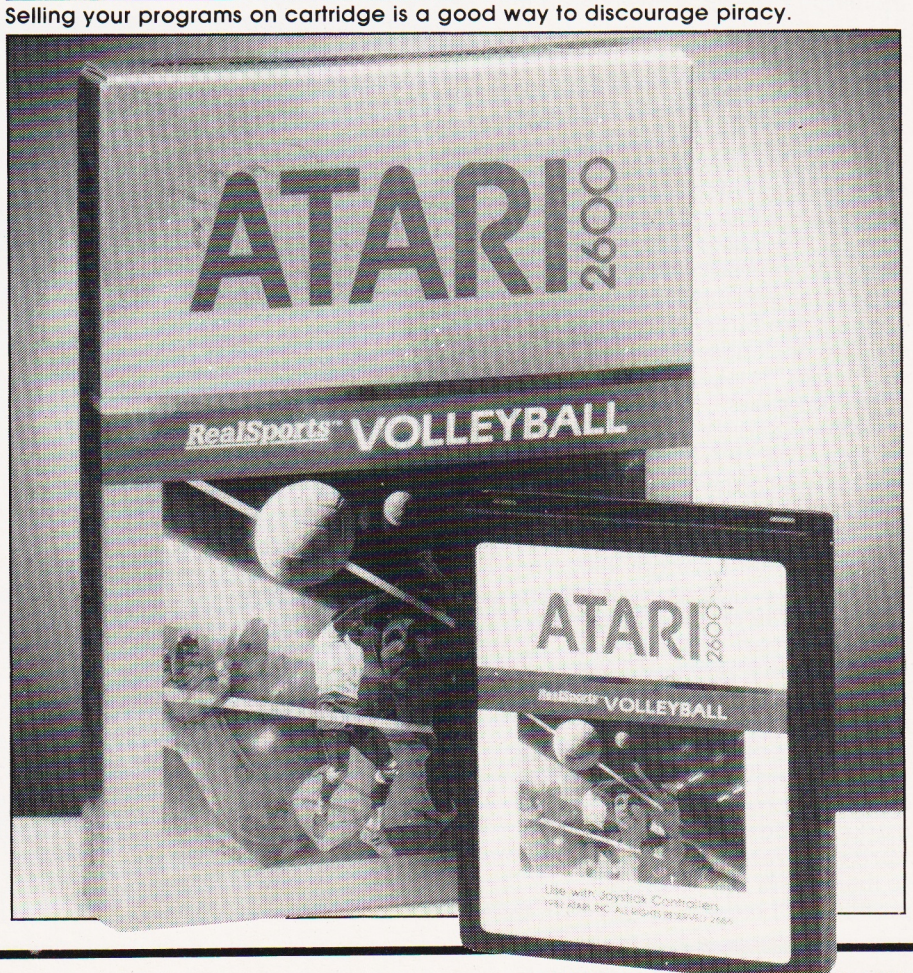
New tricks are constantly discovered by publishers. Just as persistently users work out how to 'crack' them. This represents a tremendous cost to the publisher — sometimes as much as the cost of writing the program itself.

PIRATES IN CHAINS

Bootleg copies of programs generally travel through more than three or four pairs of hands in their lifetime. Within weeks a program can travel hundreds of miles, as it is copied again and again. Sometimes bootleg copies are even offered back to their authors! This almost unending copying leads to a chain letter situation, where first one person makes a couple of copies of a program. Those are copied a few more times. the recipients copy them again, and so on until almost every user had a copy.

It would, perhaps, be interesting to release a progam which caused the computer on which it was run to explode at, say, the tenth or fifteenth load. People would copy it before they found out the snag. Within a few weeks computers would be exploding all over the country. Luckily for those who copy, it is not possible to do this on most computers (although there is

Selling your programs on cartridge is a good way to discourage piracy.



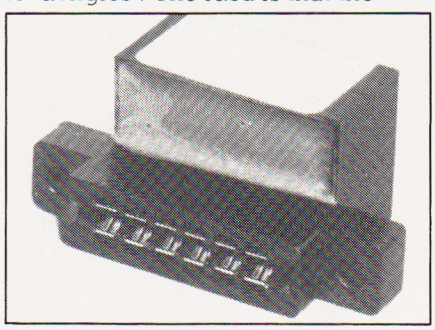
a POKE instruction which will cause early PET machines to catch fire).

In despair, software and music publishers have tried to find a way to force users to pay for their illicit copies. For years there has been a debate over whether or not blank cassettes should be subject to a surcharge. The idea is that the money thus collected could be distributed to record companies and other firms whose recorded work is often bootlegged. The problem is that nobody seems ready to work out a reasonable way of sharing out the spoils. It would be an expensive scheme to implement, and it would be unfair on blind people and those who use cassettes to record their own material.

There are many vested interests involved, including those of recorder manufacturers, tape makers, reel-tape enthusiasts and so on. Originally the scheme was confined to the music business. Recently the arrival of cassette software complicated the issue yet again. It seems unlikely that a tape surcharge will be implemented in Britain.

HARDWARE PROTECTION

Many systems of computer software protection revolve around the use of special hardware such as cartridges or 'dongles'. The idea is that the



This dongle is designed for use with a disc program for the Commodore PCT. It fits onto the cassette port.

average user should be unable to duplicate the attachment which accompanies a program. A dongle is a device which connects to a computer, interacting with software so that a program will not run unless the hard-to-copy dongle is present. This is a useful way to protect programs, although dongles are expensive and consequently they are generally only used to 'protect' costly programs.

Cartridges are another fairly successful method of protecting software. In effect they are dongles and programs all in one, since they contain a complete program in ROM. ROM copiers do exist, but they are expensive and costly to run. On most computers which use cartridges, it is possible to copy the program out of ROM and save it onto cassette. Later it can be run in RAM instead! A knowledge of electronics is often useful before this trick can be carried out, so that it is not a major source of lost revenue for software traders.

It is important to note that 'bootleg' versions of cartridge software are superficially unattractive since they must be slowly loaded from tape. A cartridge is genuinely easier to use than a tape, since it loads immediately.

SUBTLE PROTECTION

Some software houses ignore software or hardware when they protect their programs. They might ensure that a voluminous manual is needed before the software can be understood and used. Even in the age of the photocopier it is more expensive to duplicate printed material than software. Anyone who has a bootleg copy of the CP/M operating system will be familiar with this argument, although some would claim that Digital Research do not deserve any credit for their discovery!

Complicated documentation has the snag that it leads to 'unfriendly' software. Many good programs have extensive 'menus' or 'help' facilities. These must be omitted if a publisher wants to prevent bootlegging, since they reduce the value of the documentation. Some publishers have capitalised upon unfriendly software by publishing cheap books which explain the facilities of best-selling software. Often these books end up being used as 'unofficial' manuals by those with 'unofficial' copies of a program.

In the business market bootlegging is slightly less of a problem, since many customers are unwilling to use a program when they have no right to help from the authors if things go wrong. It is surprising how many people will telephone to complain of 'bugs' in programs, and then admit that they had no right to be using them — they have bootleg copies.

THE RIGHT PRICE

Computer users often complain at the high price of software. To some extent this stems from a lack of understanding of the publishing market, with its costs dominated by distribution, marketing and stock. There is an old publishing rule which says that, if you want to stay in business, the material cost of a publication should never exceed an eighth of the sale price. Even when this is considered, it is obvious that some publishers are raking in more money than this rule of thumb would suggest.

There is a circular argument which states that high prices must be maintained since most people never pay for their copies of a program. Some low-cost software has, nevertheless, sold very well, especially for newly announced computers. Still, there is a definite stage at which the software market for a given machine drops off. Once users are familiar with its quirks they can copy programs — almost regardless of software protection — quite easily. As the number of users grows they meet one another, clubs form, and the spread of copying becomes increasingly wide. A few users become specialist 'crackers', removing the protection from other people's programs as an intellectual exercise.

Of course not all computer clubs become pirate gangs, packed with people all ripping off the efforts of others. But a good many do go that way. When members are asked why they do it, the circular reasoning becomes apparent — "Software is too expensive to buy", they say.

STOP PRESS

As this article was being prepared, we received the following press release:

The UK's leading software publisher, Dataview, hopes to have created legal history in the microcomputer industry this week. They have successfully prevented an electronics company, F.A.W. Electronics Ltd, from making a device called Master Key, which had threatened Dataview's software protection system the DTL Protector — which uses the popular security key or dongle. Dataview was the first company to market successfully the now well-known dongle which protects software from illicit copying.

The threat to industry was immediately suspended when Dataview obtained an injunction which prevented F.A.W. Electronics from marketing, selling or even giving away Master Keys.

During the existence of these interim injunctions legal advisers for both sides discussed the situation and agreed to a settlement. "Dataview are on this occasion prepared to accept that F.A.W. Electronics had no intention of deliberately pirating their software, nor any software from other companies using DTL Protector or any other protection system, but had innocently stumbled into a situation whose ramifications they did not fully appreciate" said Paul Handover, Chairman and Managing Director of Dataview. Both parties have consented to the present injunction continuing perpetually and for all existing Master Keys to be delivered to Dataview.

Dataview's position was based on case law previously not used in the computer industry, which concerned itself with a third party acting in a way which induced a breach of contract between a supplier and their customer. This could well have important ramifications for software houses in the future.

'NOW WIN THE POOLS'

THIS IS MEANT FOR **YOU** — ESPECIALLY IF YOU USE A SINCLAIR ZX81 or SINCLAIR SPECTRUM COMPUTER, or even ANY COMPUTER.

HAVE YOU EVER HAD THAT DREAM OR EVER WISHED THAT YOU HAD "WON ON THE POOLS" — AT LAST YOU CAN TURN IT INTO REALITY.

THERE **IS** A SECRET OF "HOW TO WIN ON THE FOOTBALL POOLS" — **IT CAN BE DONE.** I DISCOVERED THE SECRET A LONG TIME AGO — NOW, **FOR THE FIRST TIME** I'M PREPARED TO SHARE IT WITH YOU.

HOW DOES THIS INTEREST YOU — I HAVE DOCUMENTARY EVIDENCE BY WAY OF POOLS WINNINGS DIVIDEND SLIPS/ CANCELLED CHEQUES, etc, SHOWING MY PRESENT WINS ON THE POOLS AS FOLLOWS:—

First Dividends	Second Dividends	Third Dividends	Fourth Dividends	Fifth Dividends	Sixth Dividends
765	1,818	2,942	1,952	631	93

A GRAND TOTAL OF 8,201 (EIGHT THOUSAND, TWO HUNDRED AND ONE DIVIDENDS — so far).

I HOLD THE UNCHALLENGED WORLD'S RECORD FOR POOLS WINS

I AM MAKING THIS VERY SPECIAL, REDUCED PRICE OFFER TO READERS OF COMPUTING TODAY FOR A LIMITED PERIOD ONLY.

Do not let anyone tell you that it is impossible to "WIN ON THE POOLS" — since I perfected my method, **I HAVE WON REGULARLY** for over **TWENTY-FIVE YEARS** — proof that it is no 'flash-in-the-pan'.

I have CHALLENGED THE WORLD with my record of wins and with all the evidence that I possess — NO ONE has ever been able to accept the Challenge — I KNOW NO ONE EVER WILL.

MY SECRET IS NOW PLACED ONTO COMPUTER CASSETTE FOR YOU.

THE METHOD IS THE GREATEST TREBLE CHANCE WINNER IN THE HISTORY OF FOOTBALL POOLS — IT WILL LAST FOREVER — BOTH FOR ENGLISH AND AUSTRALIAN FOOTBALL POOLS, WITH EQUAL SUCCESS.

I now intend to give a limited number of people the opportunity of making use of my method — perfected over 25 years and proving itself on **EVERY ONE OF THOSE TWENTY-FIVE YEARS.**

You will have noted details of my personal achievements so far, as given to you above.

A GRAND TOTAL of 8,201, yes 8,201 POOLS DIVIDENDS, including **765 FIRST DIVIDENDS.**

My Pools Winnings Dividend slips now number so many, that they fill a very large suitcase and will stand as my evidence of all claims in **ANY COURT OF LAW IN THE WHOLE WORLD.**

Taking just the past 25 years into consideration, I have won ON AVERAGE over 328, (THREE HUNDRED AND TWENTY—EIGHT) Pools Dividends **EVERY YEAR** — or — AN AVERAGE of over **SIX DIVIDENDS EVERY WEEK** for **TWENTY—FIVE YEARS.**

You have my absolute Guarantee of the complete authenticity of every claim, cheque, document, letter, etc, contained herein.

I do have losing weeks, but ON AVERAGE my winnings show over SIX DIVIDENDS **EVERY WEEK** for the past 25 years.

I know that you are now utterly flabbergasted, it always happens to everyone with whom I come into contact. Please just sit back and **imagine** for a moment my **FIRST DIVIDEND** wins alone — they now number 765 (seven hundred and sixty-five) and will probably be even more by the time this advertisement appears in print.

I AM NUMBER ONE IN THE WORLD AND NO ONE DISPUTES IT.

For as long as I continue to enter the Football Pools my wins will continue. I have already said, they apply, with equal success to both English and Australian Football Seasons.

I intend to release a STRICTLY LIMITED NUMBER of copies of my cassette, (either for Sinclair ZX81 or Sinclair Spectrum) — DO NOT DELAY AND FIND YOU ARE TOO LATE, in which case I would have to refund your money.

I am so confident of **YOUR** success that if do **not** win at least THREE FIRST TREBLE CHANCE DIVIDENDS in the first 20 weeks of entering, I will completely cancel the balance of the purchase price and you do not have to pay me another penny, at any time, no matter how vast your winnings.

I only wish that space would allow me to give you photographs of my winnings slips, cancelled cheques, etc, but it is of course impossible — they now number 8,201 dividends. I have however given JUST A FEW EXTRACTS from ORIGINAL LETTERS I hold from my small Clientele.

I am the Inventor and Sole Proprietor of my method, Registered as EUREKA — ('I have found it'). I am known as The Professor in Pools Circles — I am of the Highest Rank in Forecasting — this is beyond dispute. I am marketing a limited number of Computer Cassettes, under my Registered Company — FOOTBALL ENTERPRISES.

My initial charge for a copy was £75, but for this SPECIAL REDUCED PRICE OFFER I will send you a copy, (for ZX81 or Spectrum) for £20, (twenty pounds) ONLY, plus your Promise to pay me the balance of £55 — **ONLY** IF YOU WIN AT LEAST THREE FIRST TREBLE CHANCE DIVIDENDS IN YOUR FIRST 20 WEEKS OF ENTERING — otherwise you owe me NOTHING FURTHER.

This is surely proof absolute of my supreme and utter confidence in my own abilities and in the capabilities of my discovery. I could easily CHARGE £2,000 per cassette on the evidence I possess, but that would not be fair to everyone, which is what I want to do.

My method is WORLD COPYWRIGHT, any infringement and immediate proceedings will be taken, without prior warning. It is truly ingenious and has stood the test of time.

My cassette is simplicity itself to operate and you'll be given FULL DETAILS for weekly calculating. Your entry need not involve you in any large weekly stakes, you can enter for as little as 25p, if you wish.

I charge NO COMMISSION on any of your wins — no matter how BIG they may be.

I realised a long time ago, that it was no good sitting down and **dreaming** about winning the pools, so I burnt the candle at both ends, working late into the night, occasionally RIGHT THROUGH THE NIGHT, I **KNEW** there was a way, eventually it all paid off and has been doing so ever since.

I am unable to vary my offer to anyone, so please do not request it, as I shall very easily dispose of the cassettes I have prepared and am making available.

IMMEDIATELY I perfected my method I commenced winning right away, (first with just a little £163, the first week I used it), I HAVE NEVER LOOKED BACK SINCE, amongst all those dividends was one for over **EIGHT THOUSAND POUNDS** for just **one eighth of a penny stake.**

I will release a copy on cassette, to you, on receipt of the completed order form and your Signature thereon, confirming you will treat it in the STRICTEST CONFIDENCE between us and retain it for your **OWN USE ONLY.**

PLEASE NOTE:
If you happen to be the proud owner of a Computer, **other than** a Sinclair ZX81 or Sinclair Spectrum, you can still purchase a copy of my method, for the same price and program it YOURSELF on to YOUR OWN COMPUTER.

Don't take my word for it, read what people write about me and my method:—

I won on Zetters last weekend. It was not a big sum, but all the same it was a very nice surprise for me. J.C., Lancs.

I appreciate the straightforward method you adopt, which is such a contrast to the rubbish of misrepresentation which is so common in the Betting World, by unscupulous and self-opinionated charlatans. C.H., Devon

Winnings cheque received today, sincere thanks. D.N., Devon

I congratulate you on your achievement. R.R., Wales

I should like to thank you for a most exciting season and look forward to hearing from you again. J.C., Hants.

I would like to acknowledge cheque and say how much I appreciate your integrity. J.M., Scotland

Many thanks for your system, it is all you say and more. J.C., Lancs.

Your wonderful system won me £3,527. I intend to visit London soon and will be able to come and see you personally. (Overseas Client). P.M., Kampala.

Many thanks for trying so hard to please us all, your brother should be thanked also. One of our daughters, WHOSE HUSBAND YOU HELPED ENORMOUSLY, has just phoned, the four of them have just spent a lovely holiday in Spain. K.R.,Isle of Man.

I sent in my FIRST entry last week and won 2nd and 3rd dividends, as you will see from the enclosed certificate. One more and I would have collected over £400 for FIRST dividend. Once I've won a fair amount I shall be staking from winnings and at 2p per line, A FIRST DIVIDEND last week at this would have been over £3,000. C.A., Yorks.

I am very interested indeed and enclose £20 herewith. I agree to pay you the balance of £55 **ONLY** if I win at least THREE FIRST TREBLE CHANCE DIVIDENDS in my first 20 weeks of entering — otherwise I owe you NOTHING FURTHER at any time — no matter how much money I win. My Signature below is my Undertaking to retain complete and absolute confidence about the method.

Name.....

Address.....

.....

.....

Signature ..... CT 1

The Managing Director,
Football Enterprises,
'Anvon',
9 New Road,
Haverfordwest, Pembs.

Please tick if cassette is for:
Sinclair ZX81 (16K) ☐
Sinclair Spectrum (48K) ☐
Any other Computer ☐

sinclair special 3

Inside...
The New ZX Microdrive!
Latest software...
Latest prices...

The ZX Microdrive- and more!

For some time now, the new ZX Microdrive has been the subject of much discussion. Which is only to be expected, when the object of everyone's anticipation is *completely* new to the world of computing.

Microdrive provides high-speed access to truly massive storage. With just one Microdrive, you'll have at least 85K bytes of storage, and the ability to LOAD and SAVE in mere seconds. Yet the ZX Microdrive is about the size of a Spectrum mains adaptor, and costs less than £50!

First stocks are now in. Microdrives will be released on an order of priority basis. Spectrum owners who purchased by mail order, direct from us, will be sent full details including how to order, in a series of mailings that begins with the earliest names on our list.

And if you didn't buy by mail order?

Don't worry – for a colour brochure with full information on Microdrives, including how to order, just send us your name and address (use the coupon at the back of this issue of Sinclair Special). But remember, the sooner you send us your name, the sooner you'll get on the list.

Of course, there's much more to Sinclair than Microdrives, as you'll see on these pages. The latest releases of Spectrum and ZX81 software have been amongst the most successful ever. Prices of most established Sinclair products are at their lowest ever. To buy what you want, just use the Order Form.

Until the next issue of Sinclair Special, and more good news ...

Nigel Searle

Nigel Searle, Managing Director, Sinclair Research Ltd.

PS: Come and see us – and all that's new at Sinclair – at the PCW Show, Barbican Centre, from Sept 28th to Oct. 2nd. We'll be pleased to see you!

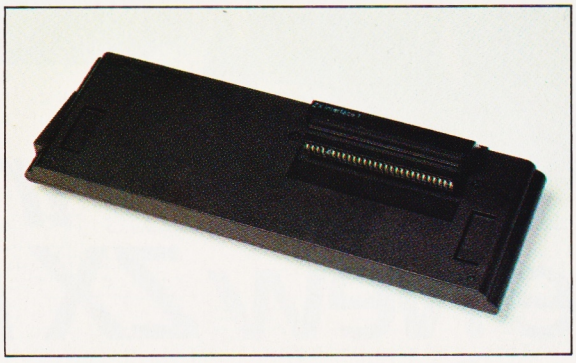
ZX Microdrive System preview!

ZX MICRODRIVE

At least 85K bytes storage, loads a typical 48K program in as little as 9 seconds: £49.95.

ZX MICRODRIVE CARTRIDGE

Compact, erasable, revolutionary. Complete with its own storage sleeve. Contains up to 50 files, with a typical access time of 3.5 seconds: £4.95.



ZX INTERFACE 1

Necessary for sending and receiving data from ZX Microdrive. Includes RS232 interface, enables creation of local area network of 2 to 64 Spectrums. Attaches to the underside of your Spectrum. Purchased with ZX Microdrive, just £29.95. As separate item, £49.95.

Six new ways to make more of your Spectrum

Take a look at these brand-new titles. Each is an outstanding new program using the full potential of the Spectrum, for games with stunningly animated graphics, for strategies of fiendish cunning, for masterly applications of computing capability...

Cyrus-IS-Chess Based on the Cyrus Program, which won the 2nd European Microcomputer Chess Championship *and* trounced the previously unbeaten Cray Blitz machine. With 8 playing levels, cursor piece-movement, replay and 'take-back' facilities, plus two-player option. The 48K version has many additional features including an extensive library of chess openings. For 16K or 48K RAM Spectrum.

Horace and the Spiders Make your way with Horace to the House of Spiders, armed only with a limited supply of anti-spider-bite serum. In the house, destroy the webs before the spiders can repair them. Then destroy the spiders, before *they* destroy Horace! Undoubtedly the creepiest Horace program ever produced! For 16K or 48K RAM Spectrum.

Computer Scrabble The famous board game, on-screen – with the whole board on view! A huge vocabulary of over 11,000 words. Full-size letter tiles, four skill levels – the highest of which is virtually unbeatable. For 1 to 4 players. For 48K RAM Spectrum.
(SCRABBLE trademark and copyright licensed by Scrabble Schutzrechte und Handels GmbH – a J.W. Spear and Sons PLC subsidiary.)

Backgammon A fast, exciting program, with traditional board display, rolling dice and doubling cube. Four skill levels. For experts – or beginners. (Rules are included – it's the quickest way to learn the game.) For 16K or 48K RAM Spectrum.

FORTH Learn a new programming language, as simple as BASIC, but with the speed of machine code. Complete with Editor and User manual. For 48K RAM Spectrum.

Small Business Accounts Speeds and simplifies accounting work, produces Balance Sheets, Profit and Loss information *and* VAT returns. Complete with User manual. For 48K RAM Spectrum.

Overleaf – your Sinclair order form.

Latest ZX81 software

These three new cassettes offer two totally different challenges to you and your ZX81. The games — like so many ZX81 games today — really do use the ZX81's capability. The FORTH program is a fascinating extension of your own computer understanding.

Sabotage. Defender or attacker? The choice is yours in this exciting game.

Be the guard and defend the ammunition in the compound — or be the Saboteur and attack it!

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

City Patrol. You are the Commander of a laser-firing ship. Your task is to intercept and destroy alien suicide ships descending on your city.

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

FORTH. Discover a new programming language which combines the simplicity of BASIC with the speed of machine code. FORTH's compiled code occupies less than a quarter of the equivalent BASIC program and runs ten times as fast. Free User-Manual and Editor Manual with each cassette.

Written by Artic for a ZX81 with 16K RAM. Cassette price: £14.95.

Prices round-up

ZX Spectrum 48K
now just **£129.95.**

ZX Spectrum 16K
now just **£99.95.**

ZX81 now just **£39.95.**

16K RAM Pack for ZX81
£29.95.

ZX Printer now just **£39.95.**

1.2A ZX Mains Adaptor
£7.95.

Printer Paper (5 rolls)
£11.95.

How to order

Simply fill in the relevant section(s) on the order-form below. Note that there is no postage or packing payable on Section B. Please allow 28 days for delivery. Orders may be sent FREEPOST (no stamp required). Credit-card holders may order by phone, calling 01-200 0200, 24 hours a day. 14-day money-back option.

sinclair

Sinclair Research Ltd,
Stanhope Road, Camberley,
Surrey GU15 3 PS.
Telephone: (0276) 685311.

To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR.

ORDER FORM

Section A: hardware purchase

Qty	Item	Code	Item Price £	Total £
	ZX Spectrum – 48K	3000	129.95	
	ZX Spectrum – 16K	3002	99.95	
	ZX 81 (including 1.2A Mains Adaptor)	1003	39.95	
	16K RAM pack for ZX81	1010	29.95	
	ZX Printer	1014	39.95	
	1.2A Mains Adaptor, for use with ZX81 computer/ZX Printer combination (only required if you have an early ZX81 with 0.7A Adaptor)	1002	7.95	
	Printer paper (pack of 5 rolls)	1008	11.95	
	Postage and packing: orders under £90	0028	2.95	
	orders over £90	0029	4.95	
			TOTAL £	

Section B: software purchase

Qty	Cassette	Code	Item Price £	Total £
	FOR SPECTRUM			
	G22/S:Backgammon	4021	5.95	
	G23/S:Cyrus-IS-Chess	4023	9.95	
	G24/S:Horace & the Spiders	4022	5.95	
	G25/S:Scrabble	4024	15.95	
	L1 /S:FORTH	4400	14.95	
	B6 /S:Small Business Accounts	4605	12.95	
	FOR ZX81			
	G25: Sabotage	2124	4.95	
	G24: City Patrol	2123	4.95	
	L1: FORTH	2400	14.95	
			TOTAL £	

*Delete/complete as applicable.

*I enclose a cheque/postal order made payable to Sinclair Research Ltd for £

*Please charge to my Access/Barclaycard/Trustcard account no:

Signature

Mr/Mrs/Miss

Address

COT 909

(Please print)

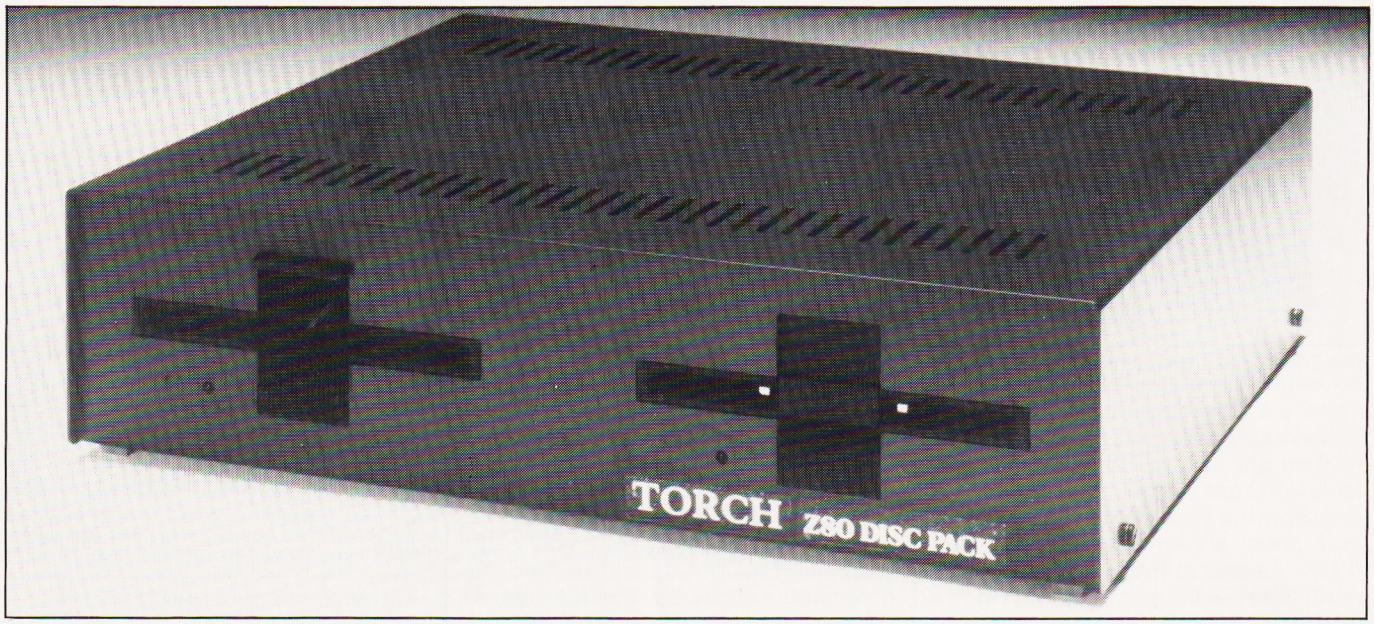
ZX Microdrive information request

Please send me a colour brochure with full specifications of ZX Microdrive/Interface 1, *and* add my name to the Microdrive Mailing List! *(tick here)* ☐ (Remember to include your name and address on the form above).

Henry Budgett

DISCUSSING THE TORCH

CP/M on the Beeb at last? We applied a Torch to our BBC Micro and this is what happened.



The route to discs is not a hard one for the BBC Microcomputer owner; the BBC's DFS interface will cope with many of the commonly available 5¼" drives on the market. This means that if you don't want to part with the £265 for an official BBC 100K disc drive, or £804 for a pair of 400K drives, you can buy one of the many proprietary units and usually be guaranteed of both a financial saving and a product which works just as well. As to whether the BBC's disc operating system, DFS, is as good as it could be, I won't pass judgement! Suffice it to say that the Acorn-designed software leaves a lot to be desired in many respects, but then so do many other commercially available disc operating systems.

How, therefore, can the BBC Microcomputer owner get at a different disc operating system? Well, the BBC have been promising a Z80 second processor option to allow access to CP/M ever since the system was first specified, but they have been beaten to the punch by Torch Computers of Cambridge. This company evolved from the partnership of two venture capitalists and the management of Acorn, and was originally set up to produce a business computer system called the Torch, which is partially based around the BBC Microcomputer's main PCB. As part of the deal, the management of Torch would provide the software and the Acorn team would put together the hardware to link a Z80 processor onto the BBC Microcomputer's Tube and thus allow the industry 'standard' DOS, CP/M, to be used.

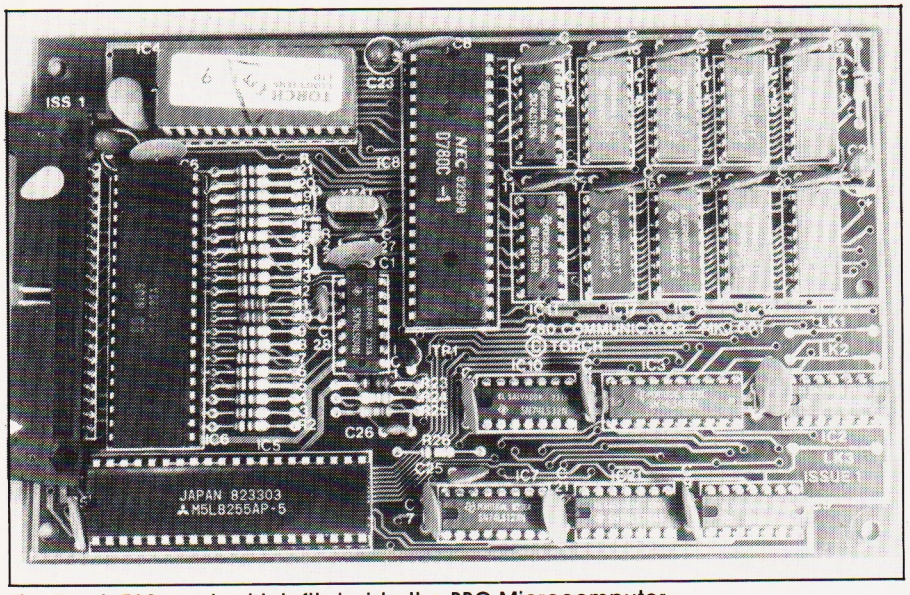
Sadly the partnership dissolved because the Acorn team was too tied up with the BBC project's problems to be able to complete the Z80 card in time, and the Torch team had to go it alone. The Torch computer that eventually resulted has proved to be an excellent product which features high in the opinion of most technical journalists and companies alike. So, how did Torch solve the problem of fitting a Z80 card onto the BBC Microcomputer and what has that got to do with their Disc Pack?

Obviously once Torch had solved the problem for their commercial system, they were free to use exactly the same technique to produce a disc pack for the BBC Microcomputer which would also incorporate a Z80 processor and sufficient memory to allow the CP/M disc operating system to be used as an alternative to the BBC's DFS. The Torch Disc Pack comprises two 400K 5¼" half-height discs in a slimline brown case that fits neatly under the BBC Microcomputer, a Eurocard-sized PCB with the Z80 and 64K of RAM that lives inside the BBC Microcomputer's case, and a price tag of £897. As no proper manuals were yet ready, the Disc Pack was supplied with the Torch's manuals, plus a small pile of photocopied sheets detailing the installation procedure and a disc with a number of utility programs. Proper manuals are now available.

CHOP AND CHANGE

Neither of the office BBC Microcomputers were fitted with the DFS interface (a vital requirement even at £110!), so the entire conversion had to be undertaken before any testing of the Disc Pack itself could start. At this point I think I should state that unless you are ***very*** confident about installing ICs into your BBC Microcomputer and, in some cases, cutting PCB tracks and making wiring changes then don't attempt this yourself; get your dealer to do it for you. Despite access to a BBC Hardware/Service manual, not generally available to the public, the Torch instructions proved insufficient for me to get everything up and running happily.

The disc interface itself went in easily enough, apart from two minor problems. The first was that the MOS 1.2 (you must have this new MOS — how many more can we expect?) was supplied on a 'butterfly board', and this simply wouldn't fit because of a two-pin connector sticking up from the BBC Microcomputer's PCB. This problem was 'solved' by carefully filing a suitable notch in the butterfly board so that the connector didn't foul the board any more — hardly a satisfactory solution. The second problem is that many of you will have Issue 3 PCBs and these ▶



The Torch Z80 card, which fits inside the BBC Microcomputer.

need a wiring modification. However, when you link pin 9 of IC89 to pin 11 of IC78, you must first isolate them from the board by bending the legs out of their sockets and then solder a lead between them. As one of these ICs is the disc controller, a 40-pin chip, it is not a job for the faint-hearted even with the right instructions!

The Acorn DFS and its interface was installed and checked before the Torch Disc Pack was fitted, a move that was to prove wise in view of the events that followed. To start with, our Disc Pack was supplied without its mains lead, even though the packing list was checked off to show it should be there; not a serious problem but frustrating none the less. The problems began when the installation got underway. Following Torch's instruction sheet, the first job was to install the CPN ROM (no, that's not a misprint but Torch's CP/M look-alike DOS) into its correct socket. We now need to remove the BBC Microcomputer's power supply, as all the necessary voltages are provided by the Disc Pack; no problems here except that the instructions say to put the power lead through the Econet hole. Both logic and the grommet supplied indicate that they really mean the unused Reset hole, and even this has to have the rear panel sticker scraped away to reveal its true size.

LEAD ASTRAY

Power supply connections having been made and checked, the next step was to fit the Z80 card. Here we really started to run into trouble. The card itself is to be mounted onto the underside of the BBC Microcomputer's lid — no problems here — and then the short lead must be connected from the card to the Tube connector. To start with there is not enough room to get the header plug out of the slot in the casing; you need to partially remove the BBC Microcomputer's PCB to make it big enough, but you can't because the power cable and its grommet foul the back of the board. OK, so you free these and get the cable out ready to mate with the Tube connector. The next problem is that there is no indication of which way round the lead goes; there are no key marks, nothing in the instructions and the diagrams don't help at all. Logic dictates the most sensible way and, surprise surprise, it's wrong! The cable must have a twist in it to help it fold up inside the case and the user has a 50-50 chance of getting it wrong.

With the board installed, hopefully correctly, the Disc Pack cable can be connected to the disc under the BBC Microcomputer and once again we find that there is a total absence of indication as to which way up the cable should go. The cable goes upside down, at least according to the conventions laid down by the BBC's own disc drive, and you've got a 50-50 chance of getting it right. The correct way is for the cable to be closest to the case and then loop down and back to the drives.

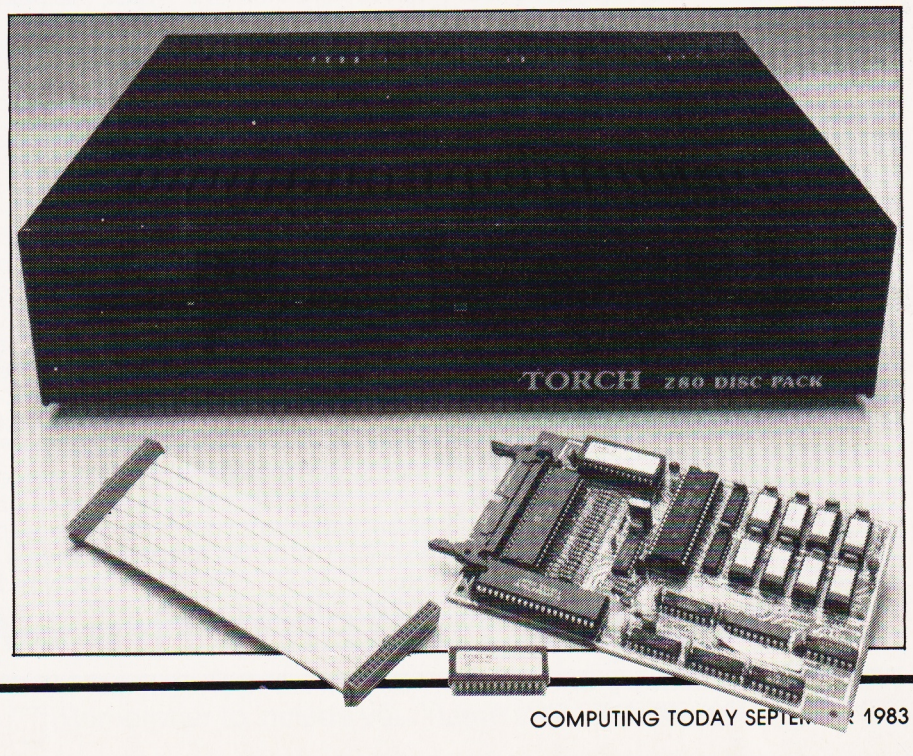
DEATH AND CORRUPTION

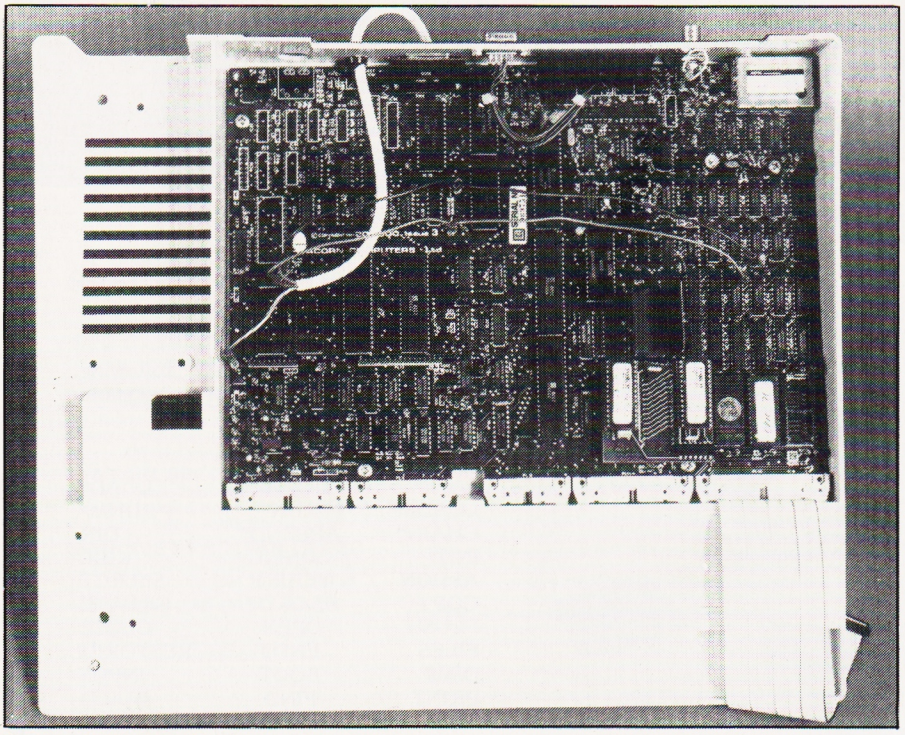
The white power cable is now plugged into the back of the Disc Pack, a suitable monitor is connected and power applied. You can forget using your TV set here as the default display Mode used is Mode 0, and televisions simply cannot handle 80 columns of text. Under normal circumstances you would get a double bleep and the screen would display the message:

```
TORCH Computer System (v71)
Acorn DFS
CPN
0A>
```

to show that all is well and operational.

In our case, nothing. Rapid checks established that it was probable that the disc cable was upside down — the drives were running constantly — and so this cable was reversed. Still nothing. After a few false starts and some time with a multimeter it was established that putting a Torch to our beloved BBC Microcomputer had crisped something, and so we called in the experts. The only recourse was to borrow a spare BBC Microcomputer from Brainstorm, the dealers who had supplied the Disc Pack.





The hole at top left is where the BBC's power supply was: the wires from the white cable are the new power connections. At the lower right of the PCB is the CPN ROM: to its left is the DFS ROM and then the small PCB containing MOS 1.2.

With the replacement machine installed it was then discovered that the master disc supplied, but untouched until that time, was corrupted beyond salvation. The suggested reason for this was that it had slipped from its protective sleeve in transit and happily scraped itself against the manuals and anything else it could get close to. The scratching and buckling of the surface would bear this theory out. With a new disc, a spare BBC Microcomputer and the original Disc Pack the process of reviewing could, at last, begin. The time that this pandemonium and chaos had taken sadly left little time to really evaluate the full potential for the product, but I trust that the following will convey some of its capabilities.

THE SOFTWARE OPTION

The Disc Pack provides the BBC Microcomputer with two 400K disc drives that can be accessed either under Torch's CPN operating system or the BBC's own DFS, provided the ROM is fitted. The system always boots-up in the Torch CPN format, so one of the first commands that you learn is *BASIC which will revert it to the DFS; to get back to CPN is simply a matter of typing *CPN. The facilities available under CPN include FORMAT to prepare blank discs, DUP to copy discs, DIR to display the directory and TYPE to output the contents of a text or documentation file. File names can be up to eight characters long with an optional three character extension, DOC for documentation, TXT for text and DAT for data being typical examples. Individual files on a disc can be copied with the COPY command, and to make life easy a wildcard option is available where * represents any string of characters and ? represents any one character. For example, COPY *.DOC TO *.TXT would copy all files with the DOC extension into files with the same name but a TXT extension. Files may also be RENamed or DELeted as required.

As far as a user of commercially available software is concerned, CPN is completely compatible with Digital Research's CP/M system which opens up a huge library of applications software and languages to the BBC Microcomputer user. Memory is no problem as the Z80 card carries its own 64K of RAM and the CP/M programs live and run here; the BBC Microcomputer is simply used to look after the peripheral devices such as the keyboard, screen and printer.

MANUAL LABOUR

Sadly the trend of inadequate documentation that has befallen many a good product seems to have affected Torch as well. The Disc Pack is currently being supplied with manuals which relate to the Torch computer system. For example, my disc had neither Executives Aid or Cardex on it, which didn't really matter as I wasn't going to look at the software anyway, but the manuals came as standard. Now, these may be good manuals as they stand — the **Programmers Guide** goes into great detail about the internal operation of CPN and the facilities the software writer could access — but there is very little here that the first time disc user will actually be able to relate to. The **BBC DFS Manual** is poor in many respects but at least you can understand it; these are simply impenetrable to anyone but a systems programmer.

This may seem an odd point to raise but, as far as I can understand it, the purpose of buying a CP/M-compatible disc system is so that the user will be able to run commercially available software and *not* worry about how to toggle his cache! What is needed is a new manual that covers the installation procedure thoroughly and correctly (although I do feel that this should not be attempted by the end user at all), and introduces the ideas of using discs as opposed to tape and illustrates the facilities and commands available under CPN. The systems information could then be incorporated into a second manual, which would allow Torch to get rid of all the duplicated material they are forced to include for their computer because they are not allowed to supply the **BBC User Guide.**

CONCLUSIONS

As a piece of hardware the Torch Disc Pack is excellently designed and very well put together. It opens up whole new horizons to both business and personal users of the BBC Microcomputer, but it is badly let down by the lack of user-friendly documentation and a horrendously complicated installation procedure. I would feel a lot happier if I knew that the money you pay for the Disc Pack included fitting by your local dealer and that owner installation was severely frowned on, possibly to the extent of being prevented completely. In operation it proved faultless. There is one cosmetic blemish lurking in the design and that is that the drives do not always manage to eject the discs when the catch is released. I have no idea why as the problem is intermittent, but annoying none the less.

Overall, then, this is a product that turns the BBC Microcomputer from a small home computer system with a restricted memory capacity into a machine with considerable potential. It seems a little sad that Acorn couldn't get their act together in time to do it themselves and let someone else pip them to the post.

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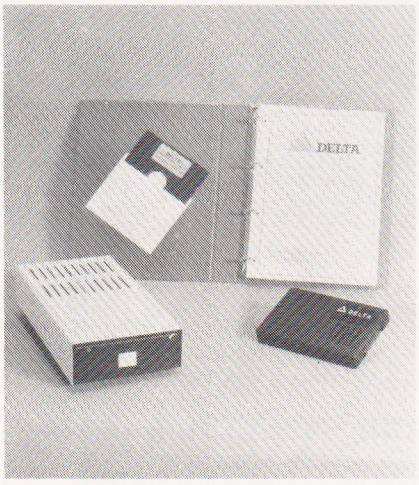

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FILES	END#	RESTORE#
DIM#	BOOT	INPUT
PRINT	FIND	BUILD
DO		IF EOF(x) THEN

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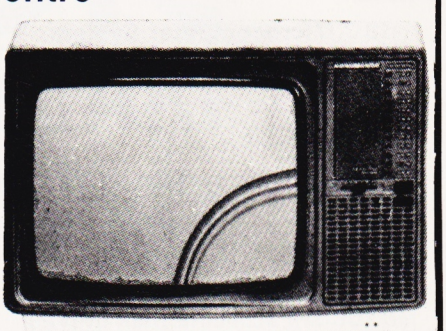

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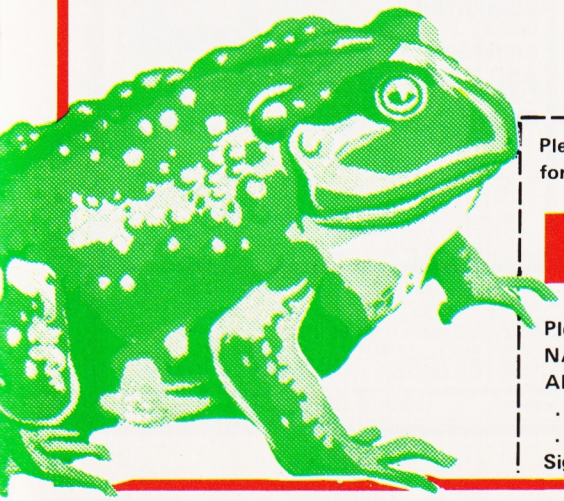

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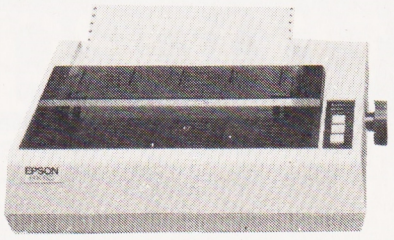

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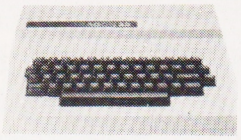

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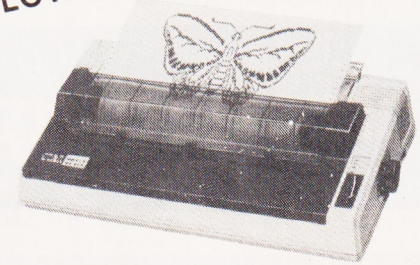

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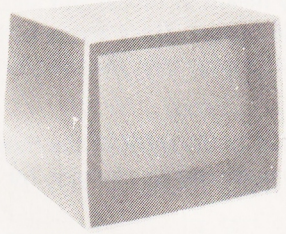

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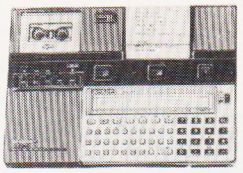

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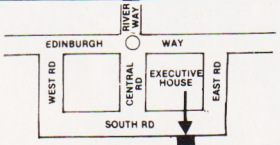

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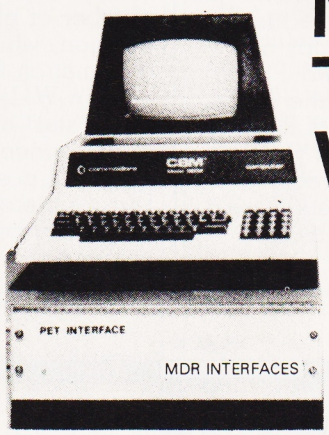

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P. J. Kenworthy

BACKGAMMON

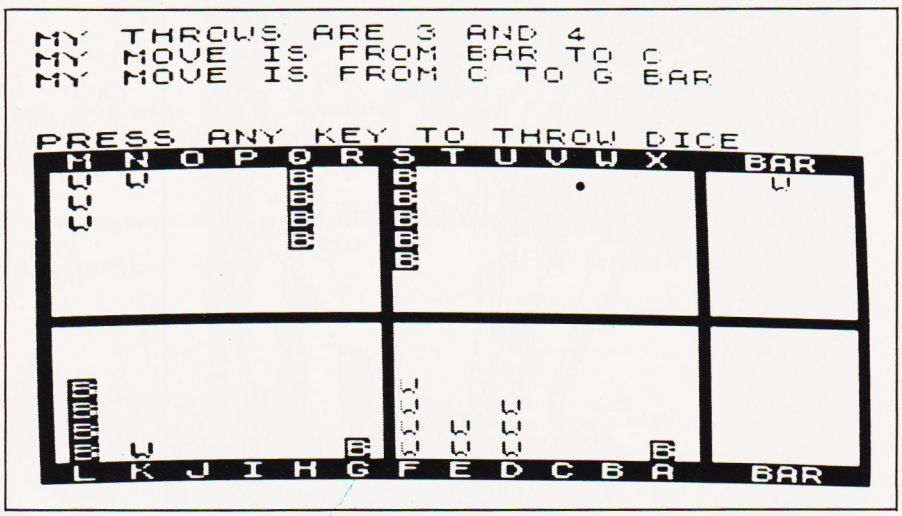
Here's a classic game brought up to date with a program for the ZX81 that plays against you and obeys all the rules.

Backgammon is one of the more popular and enduring of board games, probably because it doesn't rely solely on blind chance and the throw of the dice, but requires an appreciation of probabilities and the skill to assess the most effective use of your throws. This program puts a simulation of the backgammon board on your TV screen, and allows you to play against the computer. We aren't pretending that this piece of software could wipe the floor with Omar Sharif but it will put up a creditable fight, and can usually be guaranteed to cause you the maximum difficulty if the dice are with it. The performance is especially good when you realise that there isn't enough memory in a 16K ZX81 for a look-ahead probability tree even one turn deep.

Just to make sure that you don't get tempted into cheating it, the computer checks out everything you enter against the rules of backgammon and rejects invalid moves. The one exception is the rule stating that if a player can only use one of the numbers he has rolled, he must, if possible, use the larger. This was in the copy of rules we obtained, but two backgammon players in the office said they'd never heard of it, so we decided to leave it out. If you play by this rule, it wouldn't require more than about five or six extra lines of code: this is left as an exercise to the reader!

SIMULATION

The working of the program is based on the two position arrays W( ) and B( ), which correspond to the points on the backgammon board. The board consists of 24 positions, or points, each of which may hold any number of pieces (of the same colour) up to the total number in play. The array elements B(1)-B(24) hold the number of black pieces per position, while the corresponding information for the white player is held in W(1)-W(24). For example, at the start of the game B(1) is set to two, since there are two black pieces at position A on the board. During the course of the game these array elements are constantly changing.



Two further elements of each array are used in the game, these being W(31), B(31), W(35) and B(35). The first two hold the number of pieces each player has on the bar, while the second two hold the number of pieces each player has taken off the board at the end of the game.

The computer uses the position arrays to work out its move. For every move that the computer makes, the routine shown in the flowchart of Fig. 2 will be carried out. To give an example, suppose one of the computer's throws is a five. The program will look at each black piece, take the index of its position in the array and add five to it. It can then see the effect of moving the piece five places — whether the move is legal, whether a white piece could be taken, whether a position could be fortified and so on. If the computer is satisfied that the move is a good one, it is carried out.

Things get more complicated when the computer has to check whether a move that you have made is legal. The player's dice throws are stored in a third array, T( ), to simplify the checking routines by using FOR-NEXT loops. If the dice throws are not equal, the two numbers are put into T(1) and T(2) in descending order (using T(5) as a temporary store) and the remaining array elements made zero. Otherwise doubles have been thrown, and the first four elements of the array are all made equal, T(5) again ending up as zero.

If a player's move is judged to be valid, the dice throw corresponding to that move must be tagged as 'used' by setting it to an 'impossible' value. We decided that the answer was to use 42!

Since the three arrays completely describe the state of the game with respect to piece positions and dice in play, the

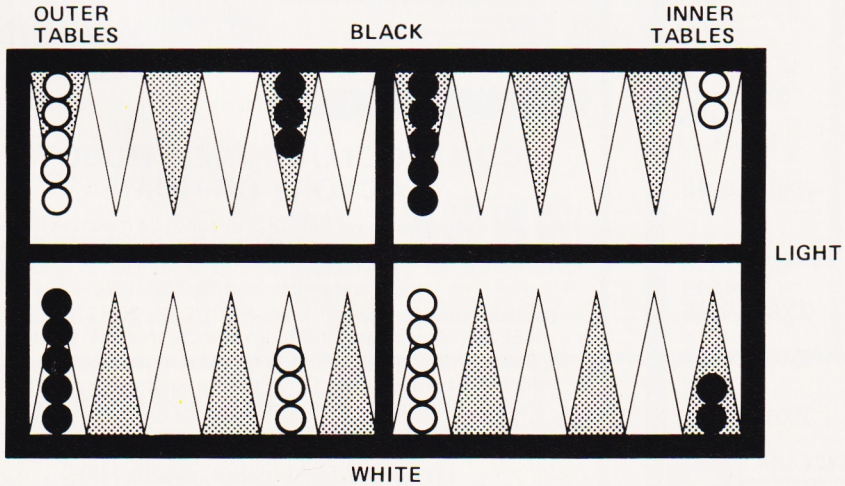
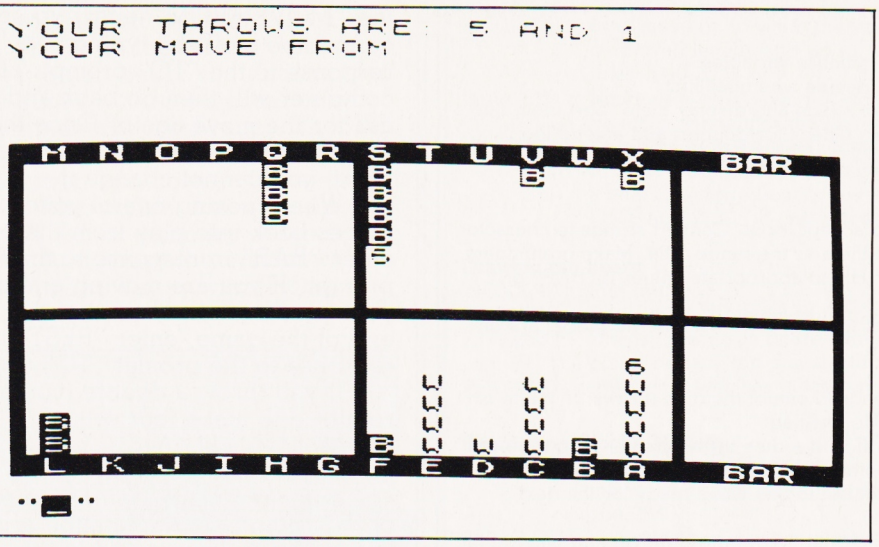


Fig.1. The starting position for backgammon.



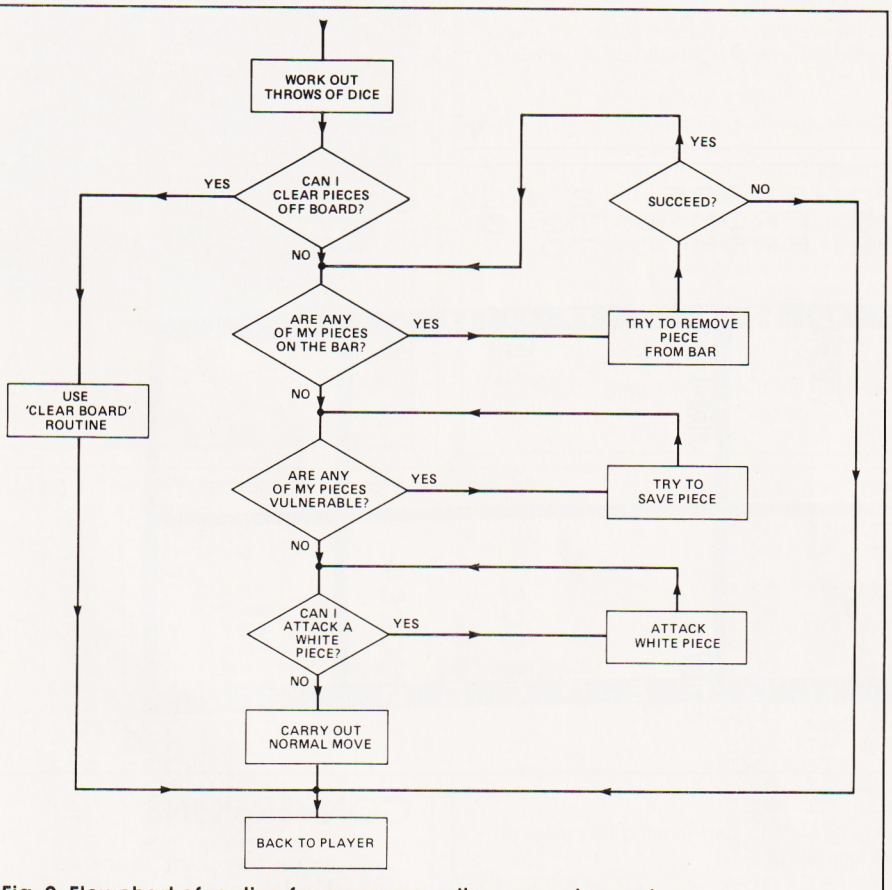


Fig. 2. Flowchart of routine for every move the computer makes.

VARIABLE	FUNCTION
C (=M)	Random number used for computer's first throw
D (=V)	Random number used for computer's second throw
G$,GG	Player's move (from)
H$,HH	Player's move (to)
DD	Distance of a player's move
F,J,K,L, N,S,Q,T, U,X,CC,TT	General purpose loop counters and flags
W( )	Position array for white pieces
B( )	Position array for black pieces
W(31)	White pieces out of play on the bar
B(31)	Black pieces out of play on the bar
W(35)	White pieces moved off the board
B(35)	Black pieces moved off the board
T( )	Array containing White's dice throws

computer can run through a series of tests involving AND, OR and the arithmetic operators, one test per rule. As an example, the test that a player is genuinely unable to move is made between lines 1370 and 1460. For each unused throw of the dice and each point on the board, line 1400 checks that the corresponding 'destination' point for White really is blocked by Black. Then line 1410 checks that, if White is on the bar, he genuinely cannot move a piece back into play.

An added complication is introduced when White starts to bear off, since it is possible to use a dice throw greater than the distance the piece is moved. Additional logic between lines 690 and 770 takes care of this.

PLAY THE GAME

It is assumed that the user of this program already knows how to play backgammon — it is not a teaching aid. The following instructions are merely to show how to play the game with the ZX81.

The player always plays White and should move in an anti-clockwise direction from X to A (see the photographs). When the program is first run, the computer may move first: if this has happened, the computer's dice throws and moves are displayed at the top of the screen. To throw your own dice, press any key, and after eight seconds or so the computer will display the board and your throws. This will happen anyway if the computer has allowed you to move first. (If you would prefer the computer to automatically throw your dice for you after an eight-second pause, delete lines 3190-3210 and change line 3320 to

3220 PAUSE 400

Pressing any key will terminate the pause early, and you can change the delay to suit your needs).

The player will then be asked for his move with the prompt "YOUR MOVE FROM" — you should enter the letter of the point you want to move from, then press NEWLINE. The prompt "TO" then appears, and the destination point is entered in a similar way. If the move is invalid, the computer will say so and repeat the above procedure.

If you can't move you should reply "NO" to the prompt "YOUR MOVE FROM" and the computer will make its next set of moves. If you've made a mistake in entering ▶

PROGRAM STRUCTURE

10-190	Dimension and initialise arrays. Initialise variables.
200	Generate a random number and decide who goes first.
220-350	Throw random numbers for player's dice and display them. Sort them into descending order for testing later. Check for doubles and amend loop counter and array if necessary.

Inputting player's moves

370-540	Display appropriate prompts and accept input. Convert strings to character codes, then subtract offset to put them in the range 1-24. Make preliminary validity checks, and alter GG or HH to appropriate values if "BAR" or "REST" have been input.
550-610	If White is bearing off, check that move is valid because no pieces are on the bar or off the inner table.
620-630	Set move distance variable.
620-680	Test that move distance corresponds to one of the dice throws. If White isn't bearing off, jump directly to 840 to test flag.
690-830	Check that, if player is bearing off with a dice throw greater than required, no White pieces are on higher point. Check that a dice throw exists to permit the required move, and set DD to this value ready for the next routine.
840-910	Check that a dice throw exists to permit the required move, and change the array values to register White's move if it's valid.
920-950	Check for a win by White and print appropriate messages. Stop program.
960-980	Check if any of Black's pieces have been taken and alter array if necessary. Loop for next move.
990	Go to Black's move.
1000-1020	Routine to display invalid move.

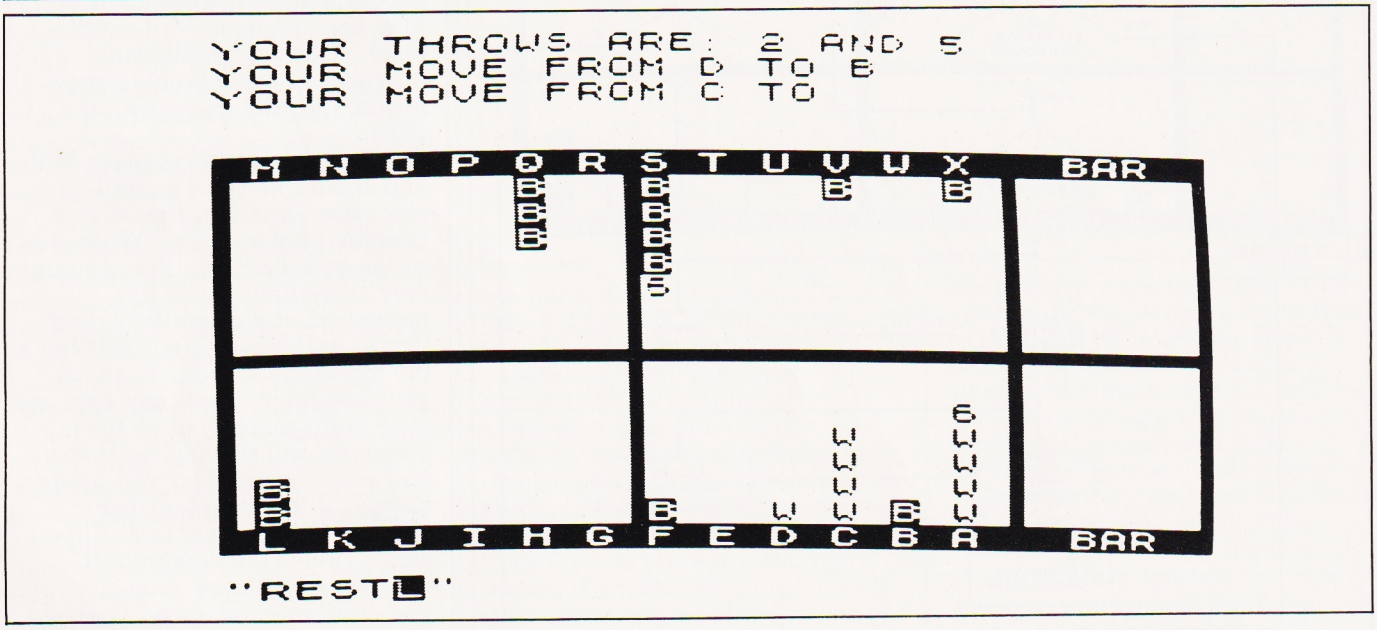
▼

the "MOVE FROM" letter, you can cancel the move by typing "NO" in response to the "TO" prompt. The computer will then go back and ask for the move again. Once the computer has accepted a move as valid, you cannot change it.

When moving one of your pieces back into play from the bar, enter "BAR" in response to the first prompt. If you are moving one of your pieces off the board at the end of the game, enter "REST" in response to the prompt "TO".

If you throw a double, you are required to make four sets of moves.

Should either you or the computer get more than five pieces on any point, a complication arises because of the restricted height of the ZX81 display. We got round this by replacing the top piece on the point with the number of pieces on the point (the photographs make this clear).



Computer's move

1030-1070	Subroutine to check whether the computer can start moving its pieces off the board (similar to routine for White above).
1080-1130, 1250-1300	Computer decides whether to make an ordinary move or move pieces off the board.
1140-1160	Remove piece from board with first move.
1310-1350	Remove piece from board with second move.
1170-1240	Display the move and change the array. Check if Black has won and display appropriate messages.
1360-1460	Entry point to computer's move routine if White has been unable to move. This is checked and a jump made to the invalid message routine if necessary. Otherwise fall through.
1470-1580	Computer's throws calculated and displayed. Loop counter altered if doubles thrown.
1590	Check to see whether any of computer's pieces are on the bar. If so, go to the bar-clearing routine at line 3120.
1600-1620	Call subroutine to check if computer can bear off. Go to bearing-off routine at 1080 if so.
1630	Decide whether to play defensively or not (go to line 1670 if not).
1640-1660	Check if any pieces are vulnerable. Go to routine at 2010 if any are.
1670-1730	First move (attack white pieces). Check to see if a black piece can move from the point in question. If a white pieces is available for taking on that spot, go to the 'take piece' routine at 2870. An identical routine for the second move is at lines 1870-1930.

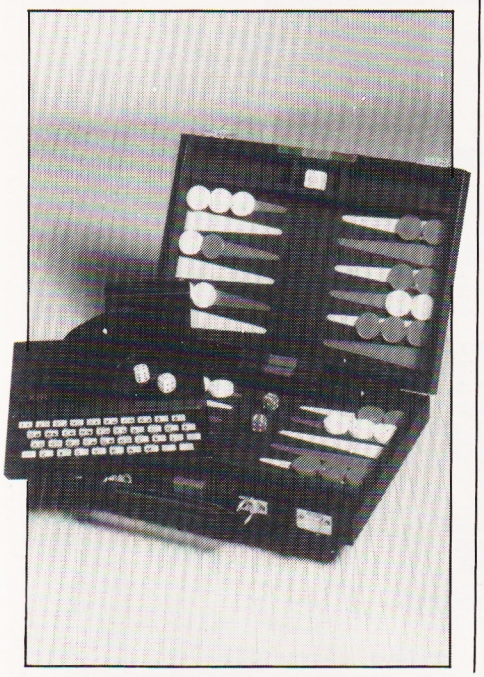
▶

CONVERSIONS

Conversion to other, more sophisticated machines should prove no problem at all. The initial board position could be set up by using READ-DATA statements. CLEAR (line 10) may need a figure after it on some machines. If you use the PAUSE version, the delay could be obtained with a FOR-NEXT loop. RAND need not be used on some machines, but may be found in the form RANDOMIZE on others. CODE is normally found in the form ASC( ), and a further complication is introduced by the non-standard ZX81 character set. On a machine using standard ASCII codes, the offset 37 in lines 390, 460, 1190, 2780, 2840, 2920, 3000, 3080, 3270, and 3390 would have to be changed to 64. RND is

usually RND(0) or RND(1).

As far as the screen display goes, much better simulations of the board should be possible on machines like the Dragon 32, BBC and ZX Spectrum due to the higher resolution and colour. If you have a machine which doesn't support PRINT AT or a similar statement, you could adapt the system we used in The Valley with [HOM] and cursor movement strings.



1750-1800	First move (if no white pieces can be attacked). Check if a black piece can be moved legally and do so. An identical routine for the second move is at lines 1940-2000.
2010-2150	Routines for the saving of exposed pieces. Check to see if a white piece can be taken with either the first move (2020), or the second move (2050), or with both moves added together (2070). If a white piece can be taken in any of these ways, the appropriate action is taken. If no white piece is exposed, a check is carried out to see if an ordinary move is possible for the piece (2100 and 2130). If one is found it is implemented.

Drawing the board

2160-2240	Plot in frame.
2250-2260	Print top and bottom of frame using inverse video characters.
2270-2600	Display pieces on board using PRINT AT. If more than five pieces are on a point, replace top piece with number of pieces.
2610-2740	If either player has pieces on the bar, display them at the side of the board.

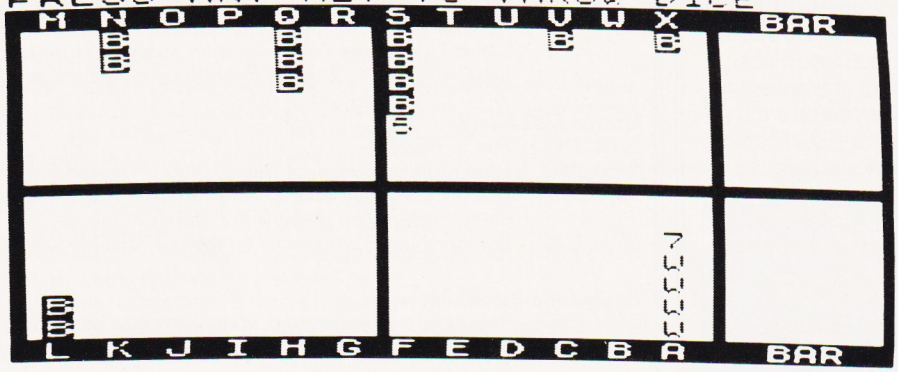
Registering Black's Moves

2750-2860	Registering of move if no white piece has been taken (2750-2800 for the first move, 2810-2860 for the second). Moves displayed on screen by lines 2780 and 2840.
2870-3020	Registering of move if white piece has been taken (2870-2940 for the first move, 2950-3020 for the second). Moves displayed on screen by lines 2920 and 3000. These moves differ from the previous set because W(31) is incremented by one and the array position that the white piece occupied is decremented by one. The player is informed that a piece has been taken by the message "BAR".
3030-3110	This routine is used if the computer has used both its throws together to take a white piece.
3120-3150	If the computer has a piece or pieces on the bar, this routine decides the printout format to be used. Line 3250 is chosen for the first move, line 3370 for the second. If the computer is unable to move, line 3150 ensures that the appropriate message is printed once only.
3160	If the computer has thrown a double, this line sends the computer back to the beginning of the movement routine to make its second two moves.
3170	Displays the board with the new moves on it.
3190-3240	Waits for the player to press a key before continuing with the next throw of the dice. May be altered to a PAUSE statement for automatic play.
3250-3480	Register moves if the computer has brought a piece back into play from the bar (3250-3360 for the first move, 3370-3480 for the second). If a white piece has been taken too, the routines at 3330 and 3450 are called.

Listing 1. The ZX Spectrum version of backgammon.

```
  10 CLEAR
  20 LET M=0
  30 LET V=0
  40 RAND
  50 LET C=0
  60 LET CC=0
  70 DIM T(5)
  80 LET D=0
  90 LET M$="MY MOVE IS FROM "
 100 DIM B(35)
 110 LET B(19)=5
 120 LET B(17)=3
 130 LET B(12)=5
 140 LET B(1)=2
 150 DIM W(35)
 160 LET W(24)=2
 170 LET W(13)=5
 180 LET W(8)=3
 190 LET W(6)=5
 200 IF INT ((RND*2)+1)=1 THEN (
OTO 1470
 210 GOSUB 2160
 220 LET F=2
 230 LET T(1)=INT ((RND*6)+1)
 240 LET T(2)=INT ((RND*6)+1)
 250 PRINT AT 0,0;"YOUR THROWS A
RE: ";T(1);" AND ";T(2)
 260 IF T(2)>T(1) THEN LET T(5)=
T(2)
 270 IF T(5)<>0 THEN LET T(2)=T(
1)
 280 IF T(5)<>0 THEN LET T(1)=T(
5)
 290 LET T(3)=0
 300 LET T(4)=0
 310 LET T(5)=0
 320 GOSUB 2160
 330 IF T(1)=T(2) THEN LET F=4
 340 IF F=4 THEN LET T(3)=T(1)
 350 IF F=4 THEN LET T(4)=T(1)
 360 FOR L=1 TO F
 370 PRINT AT L,0;"YOUR MOVE FRO
M ";
 380 INPUT G$
 390 LET GG=CODE G$-37
 400 IF G$="NO" THEN GOTO 1360
 410 IF G$="BAR" THEN LET GG=31
 420 PRINT G$;" TO ";
 430 INPUT H$
 440 IF H$="NO" THEN PRINT AT L,
1;"                "
 450 IF H$="NO" THEN GOTO 370
 460 LET HH=CODE H$-37
 470 PRINT H$
 480 IF G$="REST" THEN GOTO 1000
 490 IF H$="BAR" THEN GOTO 1000
 500 IF G$=H$ THEN GOTO 1000
 510 IF W(31)>0 AND GG<>31 THEN
GOTO 1000
 520 IF B(HH)>1 AND H$<>"REST" T
HEN GOTO 1000
 530 IF W(GG)-1<0 THEN GOTO 1000
 540 IF H$="REST" THEN LET HH=35
 550 LET Q=0
 560 IF HH<>35 THEN GOTO 620
 570 FOR S=7 TO 24
 580 IF W(S)>0 OR W(31)>0 THEN L
ET Q=1
 590 IF Q=1 THEN LET S=25
 600 NEXT S
 610 IF Q=1 THEN GOTO 1000
 620 LET DD=GG-HH
 630 IF GG=31 THEN LET DD=25-HH
 640 LET Q=1
 650 FOR T=1 TO 4
 660 IF DD=T(T) THEN LET Q=0
 670 NEXT T
 680 IF HH<>35 THEN GOTO 840
 690 LET Q=0
 700 FOR T=1 TO 4
 710 IF T(T)=42 OR T(T)=0 THEN G
OTO 760
 720 FOR S=GG+1 TO 6
 730 IF GG<T(T) AND W(S)>0 THEN
LET Q=1
 740 IF GG=T(T) THEN LET Q=0
 750 NEXT S
 760 NEXT T
 770 IF Q=1 THEN GOTO 1000
 780 LET DD=0
 790 FOR T=1 TO 4
 800 IF T(T)=42 OR T(T)=0 THEN G
OTO 820
```

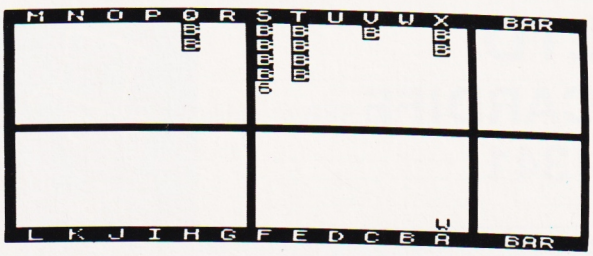
```
MY THROWS ARE 4 AND 4
MY MOVE IS FROM F TO J
MY MOVE IS FROM F TO J
MY MOVE IS FROM J TO N
MY MOVE IS FROM J TO N
PRESS ANY KEY TO THROW DICE
```



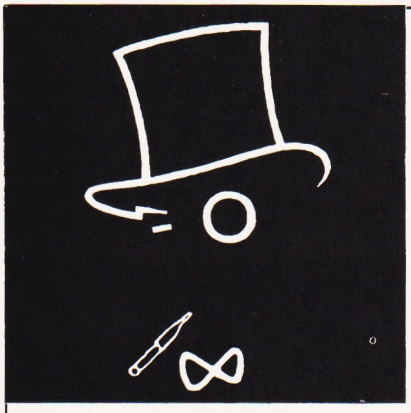

```
 810 IF T(T)>=GG THEN LET DD=T(T)
 820 NEXT T
 830 IF DD=0 THEN GOTO 1000
 840 IF Q=1 THEN GOTO 1000
 850 FOR T=1 TO 4
 860 IF T(T)=42 OR T(T)=0 THEN G
OTO 890
 870 IF DD=T(T) THEN LET T(T)=42
 880 IF T(T)=42 THEN LET T=6
 890 NEXT T
 900 LET W(GG)=W(GG)-1
 910 LET W(HH)=W(HH)+1
 920 IF W(35)=15 THEN PRINT "YOU
WIN ";
 930 IF W(35)=15 AND B(35)=0 AND
 B(31)=0 THEN PRINT "BY A GAMMON
"
 940 IF W(35)=15 AND B(35)=0 AND
 B(31)>0 THEN PRINT "BY A BACKGA
MMON"
 950 IF W(35)=15 THEN STOP
 960 IF B(HH)=1 AND HH<>35 THEN
LET B(31)=B(31)+1
 970 IF B(HH)=1 THEN LET B(HH)=B
(HH)-1
 980 NEXT L
 990 GOTO 1470
1000 PRINT "INVALID MOVE"
1010 PRINT AT L,1;"
     "
1020 GOTO 370
1030 FOR S=1 TO 18
1040 IF B(S)>0 OR B(31)>0 THEN L
ET Q=1
1050 IF Q=1 THEN RETURN
1060 NEXT S
1070 RETURN
1080 IF C=0 THEN GOTO 1250
1090 FOR X=19 TO 24
1100 LET N=X
1110 IF X+C<25 AND B(X)>0 THEN G
OSUB 2750
1120 IF C=0 THEN GOTO 1250
1130 NEXT X
1140 FOR X=(24-(C-1)) TO 24
1150 IF B(X)>0 THEN GOTO 1170
1160 NEXT X
1170 LET B(X)=B(X)-1
1180 LET B(35)=B(35)+1
1190 PRINT "I HAVE MOVED ";CHR$
(X+37);" OFF THE BOARD"
1200 IF B(35)=15 THEN PRINT "I W
IN ";
1210 IF B(35)=15 AND W(35)=0 AND
 W(31)=0 THEN PRINT "BY A GAMMON
"
1220 IF B(35)=15 AND W(35)=0 AND
 W(31)>0 THEN PRINT "BY A BACKGA
MMON"
1230 IF B(35)=15 THEN GOSUB 2160
1240 IF B(35)=15 THEN STOP
1250 IF D=0 THEN GOTO 3160
1260 FOR X=19 TO 24
1270 LET N=X
1280 IF X+D<25 AND B(X)>0 THEN G
OSUB 2810
1290 IF D=0 THEN GOTO 3160
1300 NEXT X
1310 FOR X=(24-(D-1)) TO 24
1320 IF B(X)>0 THEN GOTO 1340
1330 NEXT X
1340 LET D=0
1350 GOTO 1170
1360 PRINT
1370 FOR S=1 TO 24
1380 FOR T=1 TO 4
1390 IF T(T)=42 OR T(T)=0 THEN G
OTO 1430
1400 IF B(S)<2 AND W(S+T(T))>0 A
ND W(31)=0 THEN LET Q=1
1410 IF W(31)>0 AND B(25-T(T))<2
 THEN LET Q=1
1420 IF Q=1 THEN LET T=5
1430 NEXT T
1440 IF Q=1 THEN LET S=25
1450 NEXT S
1460 IF Q=1 THEN GOTO 1000
1470 LET C=INT ((RND*6)+1)
1480 LET X=1
1490 LET M=C
1500 CLS
1510 LET TT=1
1520 LET D=INT ((RND*6)+1)
1530 LET V=D
1540 IF M=V THEN LET X=2
1550 PRINT "MY THROWS ARE ";C;"
AND ";D
1560 FOR U=1 TO X
1570 LET C=M
1580 LET D=V
1590 IF B(31)>0 THEN GOTO 3120
1600 LET Q=0
1610 GOSUB 1030
1620 IF Q=0 THEN GOTO 1080
1630 IF INT ((RND*2)+1)=1 THEN G
OTO 1670
1640 FOR N=1 TO 24
1650 IF B(N)=1 THEN GOTO 2010
1660 NEXT N
1670 IF C=0 THEN GOTO 1810
1680 FOR N=1 TO 24
1690 IF B(N)=0 THEN NEXT N
1700 IF N+C>24 THEN NEXT N
1710 IF W(N)>1 THEN NEXT N
1720 IF W(N+C)=1 THEN GOSUB 2870
1730 IF C=0 THEN GOTO 1810
1740 NEXT N
1750 FOR N=1 TO 24
1760 IF B(N)=0 THEN NEXT N
1770 IF W(N)>1 THEN NEXT N
1780 IF W(N+C)<2 THEN GOSUB 2750
1790 IF C=0 THEN GOTO 1810
1800 NEXT N
1810 IF D=0 THEN GOTO 3140
1820 GOSUB 1030
1830 IF Q=0 THEN GOTO 1080
1840 LET TT=TT+1
1850 IF TT>1 THEN GOTO 1870
1860 GOTO 1640
1870 FOR N=1 TO 24
1880 IF B(N)=0 THEN NEXT N
1890 IF N+D>24 THEN GOTO 1940
1900 IF W(N)>1 THEN NEXT N
1910 IF W(N+D)=1 THEN GOSUB 2950
1920 IF D=0 THEN GOTO 3140
1930 NEXT N
1940 FOR N=1 TO 24
1950 IF B(N)=0 THEN NEXT N
1960 IF W(N)>1 THEN NEXT N
1970 IF N+D>24 THEN STOP
1980 IF W(N+D)<2 THEN GOSUB 2810
1990 IF D=0 THEN GOTO 3140
2000 NEXT N
```

```
2010 IF C=0 THEN GOTO 2040
2020 IF W(N+C)=1 THEN GOSUB 2870
2030 IF C=0 THEN GOTO 1660
2040 IF D=0 THEN GOTO 2060
2050 IF W(N+D)=1 THEN GOSUB 2950
2060 IF D=0 THEN GOTO 1660
2070 IF W(N+C+D)=1 THEN GOSUB 30
00
2080 IF C=0 AND D=0 THEN GOTO 31
40
2090 IF C=0 THEN GOTO 2120
2100 IF W(N+C)=0 THEN GOSUB 2750
2110 IF C=0 THEN GOTO 1660
2120 IF D=0 THEN GOTO 2140
2130 IF W(N+D)=0 THEN GOSUB 2810
2140 IF D=0 AND C=0 THEN GOTO 31
40
2150 GOTO 1660
2160 FOR N=1 TO 62
2170 PLOT N,15
2180 NEXT N
2190 FOR N=1 TO 30
2200 PLOT 0,N
2210 PLOT 63,N
2220 PLOT 50,N
2230 PLOT 25,N
2240 NEXT N
2250 PRINT AT 21,0;"
2260 PRINT AT 5,0;"
2270 FOR K=1 TO 12
2280 IF W(K)=0 AND B(K)=0 THEN G
OTO 2430
2290 IF W(K)>0 THEN GOTO 2370
2300 FOR J=1 TO B(K)
2310 LET S=J
2320 IF S>5 THEN LET S=5
2330 PRINT AT 21-S,25-(K*2);"
2340 IF J>5 THEN PRINT AT 21-S,2
5-(K*2);J
2350 NEXT J
2360 GOTO 2430
2370 FOR J=1 TO W(K)
2380 LET S=J
2390 IF S>5 THEN LET S=5
2400 PRINT AT 21-S,25-(K*2);"W"
2410 IF J>5 THEN PRINT AT 21-S,2
5-(K*2);J
2420 NEXT J
2430 NEXT K
2440 FOR K=13 TO 24
2450 IF W(K)=0 AND B(K)=0 THEN G
OTO 2600
2460 IF W(K)>0 THEN GOTO 2540
2470 FOR J=1 TO B(K)
2480 LET S=J
2490 IF S>5 THEN LET S=5
2500 PRINT AT S+6,((K-13)*2)+1;"
"
2510 IF J>5 THEN PRINT AT S+6,((
K-13)*2)+1;J
2520 NEXT J
2530 GOTO 2600
2540 FOR J=1 TO W(K)
2550 LET S=J
2560 IF S>5 THEN LET S=5
2570 PRINT AT S+6,((K-13)*2)+1;"
W"
2580 IF J>5 THEN PRINT AT S+6,((
K-13)*2)+1;J
2590 NEXT J
2600 NEXT K
2610 IF W(31)=0 AND B(31)=0 THEN
 RETURN
2620 IF B(31)=0 THEN GOTO 2690
2630 FOR J=1 TO B(31)
2640 IF J<6 THEN PRINT AT 21-J,2
8;"
2650 IF J>5 AND J<11 THEN PRINT
AT 26-J,29;"
2660 IF J>10 THEN PRINT AT 31-J,
27;"
2670 NEXT J
2680 IF W(31)=0 THEN RETURN
2690 FOR J=1 TO W(31)
2700 IF J<6 THEN PRINT AT J+6,28
;"W"
2710 IF J>5 AND J<11 THEN PRINT
AT J+1,29;"W"
2720 IF J>10 THEN PRINT AT J-4,2
7;"W"
2730 NEXT J
2740 RETURN
2750 IF N+C>24 THEN RETURN
2760 LET B(N)=B(N)-1
2770 LET B(N+C)=B(N+C)+1
2780 PRINT M$;CHR$ (N+37);" TO "
;CHR$ (N+C+37)
2790 LET C=0
2800 RETURN
2810 IF N+D>24 THEN RETURN
2820 LET B(N)=B(N)-1
2830 LET B(N+D)=B(N+D)+1
2840 PRINT M$;CHR$ (N+37);" TO "
;CHR$ (N+D+37)
2850 LET D=0
2860 RETURN
2870 IF N+C>24 THEN RETURN
2880 LET B(N)=B(N)-1
2890 LET B(N+C)=B(N+C)+1
2900 LET W(31)=W(31)+1
2910 LET W(N+C)=W(N+C)-1
2920 PRINT M$;CHR$ (N+37);" TO "
;CHR$ (N+C+37);" BAR"
2930 LET C=0
2940 RETURN
2950 IF N+D>24 THEN RETURN
2960 LET B(N)=B(N)-1
2970 LET B(N+D)=B(N+D)+1
2980 LET W(31)=W(31)+1
2990 LET W(N+D)=W(N+D)-1
3000 PRINT M$;CHR$ (N+37);" TO "
;CHR$ (N+D+37);" BAR"
3010 LET D=0
3020 RETURN
3030 IF N+C+D>24 THEN RETURN
3040 LET B(N)=B(N)-1
3050 LET B(N+C+D)=B(N+C+D)+1
3060 LET W(31)=W(31)+1
3070 LET W(N+C+D)=W(N+C+D)-1
3080 PRINT M$;CHR$ (N+37);" TO "
;CHR$ (N+C+D+37)
3090 LET C=0
3100 LET D=0
3110 RETURN
3120 IF W(C)<2 THEN GOTO 3250
3130 IF W(D)<2 THEN GOTO 3370
3140 IF C>0 AND D>0 AND B(31)>0
THEN LET CC=CC+1
3150 IF CC=1 THEN PRINT "I HAVE
BEEN UNABLE TO MOVE"
3160 NEXT U
3170 GOSUB 2160
3180 LET CC=0
3190 PRINT AT 5,0;"PRESS ANY KEY
 TO THROW DICE"
3200 SLOW
3210 IF INKEY$="" THEN GOTO 3210
3220 FAST
3230 CLS
3240 GOTO 220
3250 LET B(31)=B(31)-1
3260 LET B(C)=B(C)+1
3270 PRINT M$;"BAR TO ";CHR$ (C+
37);
3280 IF W(C)=0 THEN PRINT
3290 IF W(C)=1 THEN GOSUB 3330
3300 LET C=0
3310 IF B(31)>0 THEN GOTO 3130
3320 GOTO 1650
3330 LET W(C)=W(C)-1
3340 LET W(31)=W(31)+1
3350 PRINT " BAR"
3360 RETURN
3370 LET B(31)=B(31)-1
3380 LET B(D)=B(D)+1
3390 PRINT M$;"BAR TO ";CHR$ (D+
37);
3400 IF W(D)=0 THEN PRINT
3410 IF W(D)=1 THEN GOSUB 3450
3420 LET D=0
3430 IF B(31)>0 THEN GOTO 3140
3440 GOTO 1640
3450 LET W(D)=W(D)-1
3460 LET W(31)=W(31)+1
3470 PRINT " BAR"
3480 RETURN
```

```
YOUR THROWS ARE: 4 AND 4
YOUR MOVE FROM A TO REST
YOU WIN BY A GAMMON
```



9/950



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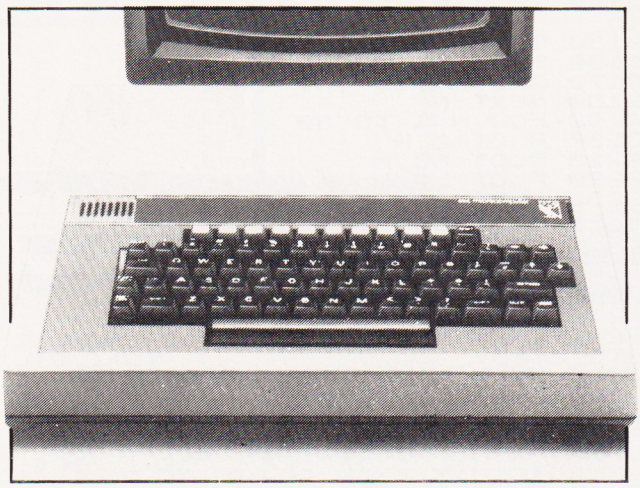

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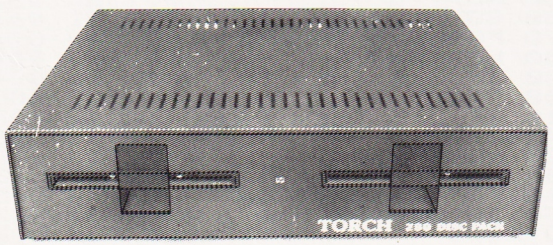

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David Mitchell

CHARACTER GENERATOR

Use a joystick and a little imagination to design your own characters on the Dragon 32.

this is an example of a
character set defined
using the character
generator program
described in this article

abcdefghijk

lmnopqrstuvwxyz

these took less than ten minutes
to design

any shape that can be defined within an
eight by eight matrix can be easily
defined. Larger designs can be produced
by combining smaller ones

use this program to produce
mathematical symbols
games graphics
arabic script
and totally illegible listings

Fig. 1. Examples of a redefined Epson printer character set.

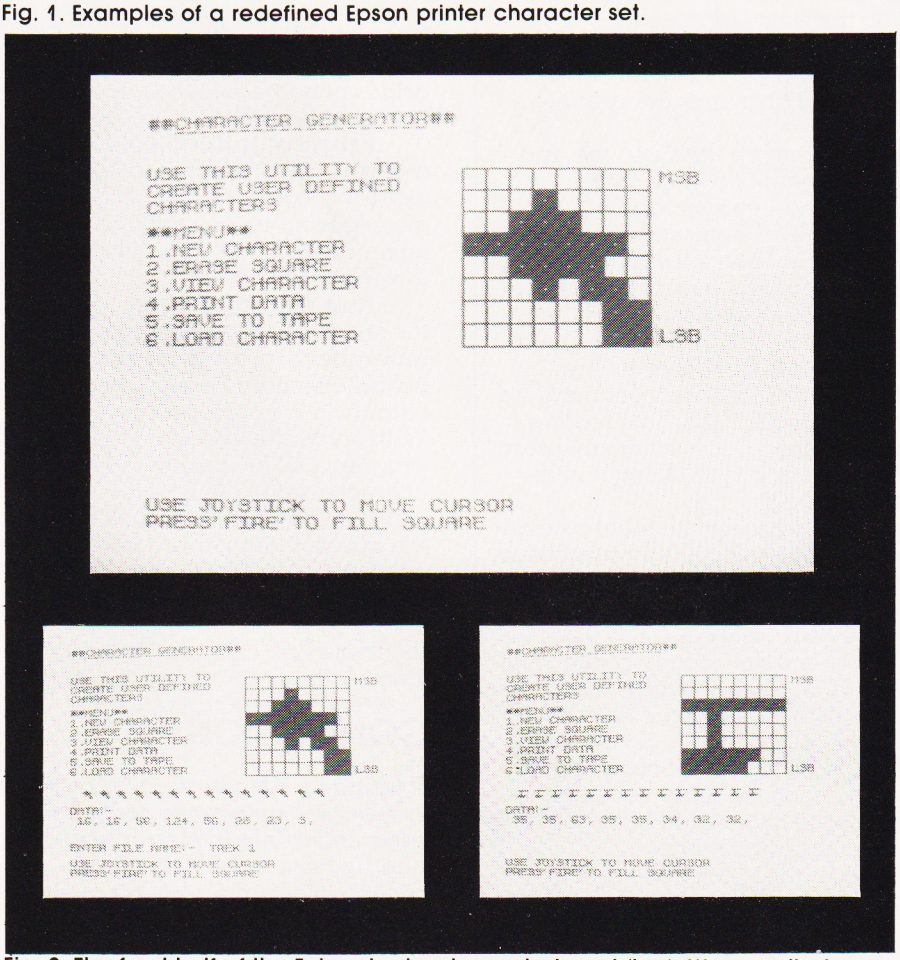

Fig. 2. The front half of the Enterprise has been designed (top). We can display actual size characters and the corresponding data, then SAVE it (below left): then we can design the rear half (bottom right).

One of the main drawbacks of the Dragon 32 is its lack of user-defined graphics. This can be overcome in any of three different ways. Shapes can be created using the DRAW command and stored in strings; this has the advantage of being fast to use but the design of any but the simplest of shapes is time-consuming, and the resulting strings can be large and use up a lot of memory. The second method is to PSET points on the screen and then save them using the GET command. The resulting array can then be PUT back on the screen at any position. This seems a good idea until you work out that, for an eight by eight character, you may have to specify up to 64 'PSET' points.

By studying the screen memory mapping in PMODE 4, a third and easier method can be used. In this mode, 6,144 bytes of screen memory are used; this is arranged in 192 rows of 32 bytes. Each byte is composed of eight bits (binary digits), each of which can either be zero or one. The first eight pixels on the high resolution screen correspond to the eight bits of the first memory location; therefore POKEing the value 255 to this byte will have the same effect as PSETing the first eight pixels on the screen (the binary for 255 is 11111111). If we POKE the same location with the value 85 a different pattern will be seen on the screen, this time corresponding to the binary code 01010101 (= 85). So to build up the same eight by eight character as in the previous example, only eight numbers need to be defined.

To define a simple box character try the following program:

```
10 PMODE4,1:PCLS:SCREEN1,1
20 FOR I=1536 TO 1792 STEP 32
30 READ X
40 POKE I,X
50 NEXT
60 DATA 255,129,129,129,129,129,129,255
100 GOTO 100
```

The only problem with this method is the actual design of the shapes and their transfer into decimal values. The following program takes care of the drudgery of converting binary numbers to decimal and allows the rapid design of user-defined graphics.

GENERATION GAME

On running the Character Generator program, a high resolution screen display appears with an eight by eight grid to one side and a menu and instructions on the other. These instructions are on the screen all the time and are

supplemented with further prompts when required. A flashing cursor can be moved around the grid using the right joystick; pressing the fire button fills in the selected square. In the event of errors, pressing key '2' will erase the square.

When a character has been created it can be viewed at normal (eight by eight pixel) size by pressing key '3'. This produces a row of identical characters for inspection. If the results are not correct they can be amended by further use of the fire button and key '2', or by pressing key '1' they can be totally erased.

Pressing key '4' at any time causes a row of eight numbers to appear, each corresponding to the binary representation of one row in the grid. These can be noted down for use in other programs or can be saved on tape.

To save characters to tape press key '5'. A screen prompt will request a file name, then tell you to set up the tape recorder. Recording only takes a few seconds and you are then able to start the next character.

Variable	Function
A$(65-122)	Defines ASCII characters
T$(1-25)	Stores the strings used to set up the screen display.
X(1-25)	Contains the x co-ordinates for the titles used in the display
Y(1-25)	Contains the y co-ordinates for the titles used in the display
B$	String used to draw the grid
CX,CY	Position of the cursor in the grid
D(1-8)	Data array
K$	Value of ASCII string to be drawn on the screen
F$	File name

Table 1. The functions of the main variables used by the program.

Line	Function
Lines 10-890	Sets up the array dimensions and defines the DRAW strings which make up a full ASCII character set. Each string is given the subscript which corresponds to its ASCII value; this makes it simpler to identify them later in the program. This allows the program to mix text and graphics on the high resolution screen, thus avoiding the need to return to the text screen to enter data or print prompts. Although lower case letters can be obtained through this method, it should be remembered that they cannot be used for file names. (By printing text in this way 42 characters per line, and 24 lines per screen can be achieved. This part of the program can be used in other programs requiring the same approach.)
Lines 1000-1280	Defines all the strings used in the program and their position on the screen, and puts them into arrays for ease of handling. Line 1270 defines the string to draw the grid.
Lines 2000-2999	Sets up the screen, drawing all titles and the grid.
Lines 3000-3060	Performs the actual drawing of strings on the screen. Handles letter and line spacing.
Lines 4000-4040	Scans the keyboard for valid menu selection and directs program flow to the relevant subroutine.
Lines 5000-5999	Clears the grid for the start of a new design and erases any data or previous patterns. Reads the joysticks and calculates the cursor position. It also flashes the cursor and detects the joystick fire button. If the button is pressed, it also performs the PAINTing in of the selected square. This routine also scans the previous one for any other key press.
Lines 6000-6060	Deletes any filled in square by PAINTing it in the background colour.
Lines 7000-7999	Transfers the design in the grid to an eight by eight pixel version, then GETs it and PUTs a row of them across the screen. It also erases any previous designs.
Lines 8000-8090	Tests each square on the grid to see if it is filled in and converts each row into the decimal value of its binary representation. It then converts each value to a string and draws it on the screen using the subroutine at 3000.
Lines 9000-9140	Handles tape output, drawing prompts and allows input of file name, again on the high resolution screen. It also detects file names which are too long and abbreviates them to eight letters.
Lines 10000-10290	Reads files in from tape, then fills in the grid as appropriate. It then returns to the main program to allow editing.

Table 2. How the program works

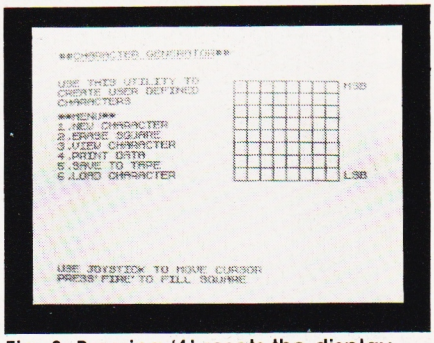

Fig. 3. Pressing '1' resets the display, ready for designing a new character.

The facility exists to read data in from a tape for alteration and re-recording; this option is accessed by key '6'. On reading in the data the grid is filled in, and the cursor begins to flash to allow editing.

Extensive use is made of error trapping, and an incorrect entry is usually accompanied by a flashing message and an invitation to try again. Sound is used (in moderation) to verify key entries.

Note that this program runs in the fast mode; if you press 'Break' remember to press the Reset button before attempting any input or output via the cassette.

With very little alteration the program can be used to redefine the character set of the Epson FX-80 printer. The only difference is that the Epson characters are defined in columns rather than rows. The program can be used as it stands to create sprite graphics for users of the 'High Res' cartridge from Compusense.

CONVERSION

It would be simpler to copy the idea and write your own version of this program, rather than to attempt a line-by-line conversion of this program. The implementation on micros which support text and high resolution graphics on the same screen should be a lot less complicated.

```
10 DIM A$(122),T$(25),X(25),Y(25),C(8,8)
15 RESTORE
16 POKE65495,0
30 A$(65)="U4E1R2F1D1NL4D3"
40 A$(66)="U5R3F1G1NL3F1D1G1L3"
50 A$(67)="BM+3,+0;NE1L2H1U3E1R2F1"
60 A$(68)="U5R3F1D3G1L3"
70 A$(69)="NR4U3NR3U2R4"
80 A$(70)="U3NR3U2R4"
90 A$(71)="BM+3,+0;E1U1L2R2D1G1L2H1U3E1R2F1"
100 A$(72)="U5D2R4U2D5"
110 A$(73)="R4L2U5L2R4"
120 A$(74)="BM+0,-1;F1R1E1U4L2R4"
130 A$(75)="U5D3R1NE3U1F3"
140 A$(76)="NR4U5"
150 A$(77)="U5F2E2D5"
160 A$(78)="U5F4D1U5"
170 A$(79)="BM+0,-1;U3E1R2F1D3G1L2H1"
180 A$(80)="U5R3F1D1G1L3"
190 A$(81)="BM+0,-1;U3E1R2F1D3NF1NH1G1L2H1"
200 A$(82)="U5R3FDGNL3FD"
210 A$(83)="BM+0,-1;F1R2E1U1H1L2H1U0E1R2F1"
220 A$(84)="BM+2,+0;U5L2R4"
230 A$(85)="BM+0,-1;NU4F1R2E1U4"
240 A$(86)="BM+0,-5;D3F2E2U3"
250 A$(87)="BM+0,-5;D4F1E1U1D1F1E1U4"
260 A$(88)="U1E4BM-4,-0;F4D1"
270 A$(89)="BM+2,+0;U3NE2H2"
280 A$(90)="R4L4U1E4L4"
290 A$(49)="R4L2U5L1G1"
300 A$(50)="NR4U1E1R2E1U1H1L2G1"
310 A$(51)="BM+0,-1;F1R2E1U1H1L1R1E1H1L2G1"
320 A$(52)="BM+3,+0;U5G3R4"
330 A$(53)="BM+0,-1;F1R2E1U1H1L3U2R4"
340 A$(54)="BM+0,-1;F1R2E1H1L2G1U3E1R2F1"
350 A$(55)="U1E4L4D1"
360 A$(56)="BM+0,-1;F1R2E1U1H1L2G1D1U1E1H1E1R2F1G1"
370 A$(57)="BM+0,-1;F1R2E1U3H1L2G1F1R2E1"
380 A$(58)="BM+1,-1;U1BM+0,-2U1"
390 A$(59)="BM+2,-4;D1BM+0,+2D8"
400 A$(60)="BM+0,-3;NE3F3"
410 A$(61)="BM+0,-4;NR3BM+0,+2R3"
420 A$(62)="BM+4,-3;NG3H3"
430 A$(63)="BM+2,+0;UUEUHLGDBM+2,+5;L"
435 A$(64)="BM+0,+4;R4D6L4U6D6L5R2OF10L40NE10D15R40U15L10BM+0,+3;DBR6U8L3D4NL3NR3ND4U4L3BM+0,-3;L20BM+0,+3;D8L6U8R3D8U4L3R6L3U4R3BM+5,+0;ND12R10D12"
440 A$(33)="BM+2,+0;UBM+0,-2U2"
450 A$(34)="BM+0,-5;DBM+2,-1;D"
460 A$(35)="BM+1,+0;U5D1NL1NR3D2NL1R3L1D2U5"
470 A$(36)="BM+0,-1;F1R2E1U1H1L2H1E1R2L1U1D7"
480 A$(37)="E4BM-4,+0;EFGHBM+4,+4;GHEF"
490 A$(38)="BM+4,+0;H3UEFG3FRE"
500 A$(40)="BM+0,-3;UUEGDDDDF"
510 A$(41)="BM+4,-3;UUHFDDDDG"
520 A$(94)="BM+2,+0;U5NF2NG2"
530 A$(10)="BM+2,+0;NE2NH2U5"
540 A$(8)="BM+0,-3;NE2NF2R4"
550 A$(9)="BM+0,-3;R4NG2NH2"
560 A$(39)="BM+1,-5;D6"
570 A$(42)="BM+2,-3;NU2ND2NR2NL2NE2NF2NG2NH2"
580 A$(45)="BM+0,-3;R3"
590 A$(46)="BM+3,+0;U1"
600 A$(44)="BM+3,-1;D6"
610 A$(47)="E4"
620 A$(48)="BM+0,-1;F1R2E1U3H1L2G1D3E3"
630 A$(97)="BM+0,-1;F1R1E1ND1NU2U1H1L1G1D1"
640 A$(98)="U5D3ERFDGLH"
650 A$(99)="BM+3,+0;LLHUERR"
660 A$(100)="BM+0,-1;FRENDUNU4HLGD"
670 A$(101)="BM+2,-0;LHURRRHLG"
680 A$(102)="BM+1,0;UUNRNLUUER"
690 A$(103)="BM+0,-1;UERFDGLHFRENUDDGL"
700 A$(104)="UUUUUDDDERFDD"
710 A$(105)="BM+2,+0;U2BM+0,-2;U"
720 A$(43)="BM+2,-3;NU2ND2NR2NL2"
730 A$(106)="BM+2,-5;DBM+0,+2;D3GLH"
740 A$(107)="U5D3RNE2F2"
750 A$(108)="BM+2,+0;U5"
760 A$(109)="U2EFDUEFDD"
770 A$(110)="UUUDERFDD"
780 A$(111)="BM+0,-1;UERFDGLH"
790 A$(112)="U3D5U4ERFDGLH"
800 A$(113)="BM+3,+0;U3D5U4H1L1G1D1F1R1E1"
810 A$(114)="U3DERF"
820 A$(115)="BM+1,+0;RREHLLHERR"
830 A$(116)="BM+1,-1;U4DDLRRLD2FRE"
840 A$(117)="BM+0,-3;DDFREUUD3"
850 A$(119)="BM+0,-3;DDFENUFEUU"
860 A$(118)="BM+0,-3;DF2E2U"
870 A$(120)="BM+2,-2;NENHGDUEFD"
880 A$(121)="BM+0,-3;DDFREUUD4GL"
890 A$(122)="NR3E3L3"
1000 REM define titles
1010 DATA"ÉÉCHARACTER GENERATORÉÉ",0,8
1020 DATA"  --------------------",0,13
1030 DATA"USE THIS UTILITY TO",0,32
1040 DATA"CREATE USER DEFINED",0,40
1050 DATA"CHARACTERS",0,48
1060 DATA"**MENU**",0,60
1070 DATA"1.NEW CHARACTER",0,68
1080 DATA"2.ERASE SQUARE",0,76
1090 DATA"3.VIEW CHARACTER",0,84
1100 DATA"4.PRINT DATA",0,92
1110 DATA"5.SAVE TO TAPE",0,100
1120 DATA"6.LOAD CHARACTER",0,108
1130 DATA"USE JOYSTICK TO MOVE CURSOR",0,183
1140 DATA"PRESS 'FIRE' TO FILL SQUARE",0,191
1150 DATA"DATA:-",0,140
1160 DATA"RECORDING....",0,170
1170 DATA"LOADING....",0,170
1180 DATA"SET UP TAPE TO PLAY",0,170
1190 DATA"SET UP TAPE TO RECORD",0,170
1200 DATA"ENTER FILE NAME:-",0,170
1210 DATA"PRESS ANY KEY TO CONTINUE.....",0,170
1220 DATA"ERROR",0,170
1225 DATA"MSB",225,36
1226 DATA"LSB",225,108
1230 FORI=1 TO 24
1240 READ T$,X,Y
1250 T$(I)=T$:X(I)=X:Y(I)=Y
1260 NEXT
1270 B$="BM140,30;R80D80L80U80D10R80D10L80D10R80D10L80D10R80D10L80D10R80L80D10R10U80R10D80R10U80R10D80R10U80R10D80R10U80"
1280 P$="BM220,0;NG19F2NG18F2NG18F2G19L5GNH18HENFENFU5E1F6"
2000 'set up screen
2010 PMODE4,1:COLOR0,5:PCLS:SCREEN1,1
2020 FORI=1 TO 14
2030 K$=T$(I):X=X(I):Y=Y(I)
2040 GOSUB 3000
2050 NEXT I
2060 DRAW B$
2065 K$=T$(23):X=X(23):Y=Y(23):GOSUB 3010:GOTO2066
2066 K$=T$(24):X=X(24):Y=Y(24):GOSUB 3010
2070 GOSUB 5038
2999 GOTO2999
3000 'screen draw routine
3005 X=X(I):Y=Y(I)
3010 FOR U=1 TO LEN(K$)
3020 A=ASC(MID$(K$,U,1))
3030 DRAW"BM"+STR$(X)+","+STR$(Y)+";"+A$(A)
3040 X=X+6
3050 NEXT U
3060 RETURN
4000 'menu select
4010 M$="123456"
4020 I$=INKEY$:IF I$="" THEN RETURN
4030 ON VAL(I$) GOSUB 5000,6000,7000,8000,9000,10000
4035 I$=""
4040 RETURN
4999 '*************************
5000 'new character
5020 LINE(140,30)-(220,110),PRESET,BF
5030 LINE(0,110)-(255,172),PRESET,BF
5035 DRAW B$
5038 CX=INT(JOYSTK(0)/8):CY=INT(JOYSTK(1)/8)
5040 PLAY"T25505L1C"
5050 PSET(145+(10*CX),35+(10*CY),0):FORT=1 TO 40:NEXTT
5055 PRESET(145+(10*CX),35+(10*CY))
5058 GOSUB 4000
5060 IF( PEEK(65280)=126 OR PEEK(65280)=254)  THEN PAINT(145+(10*CX),35+(10*CY))
:PLAY"T2505AD"
5080 GOTO5038
5999 '*************************
6000 'delete square
6020 CX=INT(JOYSTK(0)/8):CY=INT(JOYSTK(1)/8)
6030 LINE(141+(10*CX),31+(10*CY))-(149+(10*CX),39+(10*CY)),PRESET,BF
6040 PLAY"T25501CECECECEC"
6050 FORT=1 TO 100:NEXTT
6060 RETURN
7000 'veiw character
7005 LINE(0,112)-(255,172),PRESET,BF
7010 FORI=1 TO 80 STEP 10
7080 FORJ=1 TO 80 STEP 10
7090 IF PPOINT(141+I,31+J)=0 THEN PSET(10+(I/10),120+(J/10),0)
7100 NEXT J
7120 NEXTI
7130 GET(10,120)-(18,128),C,G
7140 FOR I=24 TO 200 STEP14
7150 PUT(I,120)-(I+8,128),C,PSET
7160 NEXT I
7999 RETURN
8000 'print data
8010 LINE(0,130)-(255,172),PRESET,BF
8016 K$=T$(15):X=X(15):Y=Y(15):GOSUB 3010
8017 Y=Y+8:X=0
8020 FORI=1 TO 80 STEP 10
8025 D=0
8030 FORJ=80 TO 0STEP-10
8040 IF PPOINT(142+I,38+J)=0 THEN D=D+(2^(INT((70-J)/10)))
8050 NEXTJ
8055 D=INT(D)
8060 IF SF=1 THEN 8065:ELSEK$=STR$(D)+",":GOSUB 3010
8065 D(R)=D
8066 R=R+1
8070 NEXTI
8080 R=0
8090 RETURN
9000 'save data to tape
9010 LINE(0,150)-(255,175),PRESET,BF
9020 K$=T$(20):X=X(20):Y=Y(20):GOSUB 3010
9025 X=X+10
9030 L$=INKEY$:IF L$="" THEN PLAY"T25501CD":GOTO9030
9040 F$=F$+L$
9050 K$=L$:GOSUB 3010
9060 IF LEN(F$)=8 OR ASC(K$)=13 THEN 9070:ELSE 9030
9070 SF=1:GOSUB 8020
9074 LINE(0,150)-(255,175),PRESET,BF
9075 X=0:Y=Y-8:K$=T$(19):GOSUB 3010
9076 X=0:Y=Y+8:K$=T$(21):GOSUB 3010
9077 L$=INKEY$:IF L$="" THEN PLAY"T25502CD":GOTO 9077
9078 LINE(0,150)-(255,175),PRESET,BF:X=0:K$=T$(16)+"  "+F$:GOSUB 3010
9079 POKE65494,0
9080 OPEN"O",£-1,F$
9090 FOR I=0 TO 7
9100 PRINT£-1,D(I)
9110 NEXT I
9120 CLOSE £-1
9121 POKE65495,0
9125 LINE(0,150)-(255,175),PRESET,BF
9130 SF=0
9140 RETURN
10000 'load from tape
10005 F$=""
10010 LINE(0,120)-(255,175),PRESET,BF
10020 LINE(140,30)-(220,110),PRESET,BF
10030 DRAW B$
10040 K$=T$(20):X=X(20):Y=Y(20):GOSUB 3010
10050 L$=INKEY$:IF L$="" THEN PLAY"T255V2501CD":GOTO 10050
10060 F$=F$+L$
10070 IF LEN(F$)=8 OR ASC(L$)=13 THEN 10100
10080 K$=L$:GOSUB 3010
10090 GOTO10050
10100 LINE(0,150)-(255,175),PRESET,BF
10110 Y=Y-8:K$=T$(18):X=0:GOSUB 3010
10120 X=0:Y=Y+8:K$=T$(21):GOSUB 3010
10130 L$=INKEY$:IF L$="" THENPLAY"T25502CD":GOTO 10130
10140 LINE(0,150)-(255,175),PRESET,BF
10150 Y=Y-8:X=0:K$=T$(17)+F$:GOSUB 3010
10159 POKE65494,0
10160 OPEN"I",£-1,F$
10170 IF EOF(-1) THEN 10210
10180 INPUT£-1,D
10190 D(V)=D:V=V+1
10200 GOTO10170
10210 CLOSE£-1
10211 POKE65495,0
10220 F$="":V=0
10230 FOR I=0 TO 7
10240 D=D(I)
10250 PX=141+(10*I)
10255 FOR J=7 TO 0 STEP -1
10260 PY=101-(10*J)
10270 IFD>=INT(2^J) THEN PAINT(PX,PY):D=D-INT(2^J)
10280 NEXT J,I
10290 RETURN
```

Listing 1. The complete listing of the Character Generator program.

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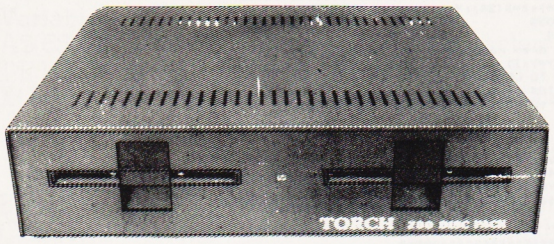

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PROCopinion

New editors for old — will the latest one make any more sense than the last? Doubt it.

The editor is dead — long live the editor. Actually the long-standing Henry Budgett (it would have been five years with the November 83 issue) has not so much passed away as passed on. Resplendent in the title of Group Software Editor, he will now be organising the programs for ASP Software, ensuring they're bug-free and written to our exacting standards. He'll also be available to the various magazines in our company for help and advice. Finally he'll be riding shotgun on the equipment we're obtaining to allow most, if not all, of the software published by ASP magazines to be listed directly to printer from a working program. This should eliminate typesetting errors and cut down drastically on the number of technical enquiries we receive.

What about me? I've come from across the corridor at Electronics Today International where I was Deputy Editor (I got partial remission of sentence for good behaviour), and hopefully I can not just maintain CT's standards (small s!), but improve them. Changing the name of this column from # File is ***not*** one of these improvements — it's just that Henry is rather possessive about the name. Anyway, what's happened lately that's been of interest?

DARKSTAR

The voice on the phone asked if I'd like to attend a press launch. The promise of free food and drink is almost but not quite enough justification for attending these events, so I dutifully asked what was being launched. "A 16-bit personal computer", came the reply. Despite the fact that 16-bit chips are available from almost every semiconductor manufacturer, relatively few of them seem to find their way into personal computers, so along I went.

Well, the Darkstar is a 16-bit personal computer like the Space Shuttle is a glider. And it establishes an important precedent in the field of R & D, as you'll see later. The machine is a major implementation of the Motorola 68000 CPU, with up to 6 Mbytes of main memory in the standard 19" rack, 40 to 320 Mbytes of hard disc, up to four 8" floppy discs (1.2 to 4.8 Mbytes of formatted storage), up to four streaming tape drives, a real time clock, and extensive I/O facilities including four serial and two parallel ports, an intelligent cluster terminal controller for eight RS232 lines, and IEEE488 and DEC Unibus interfaces.

The software makes full use of the internal 32-bit structure of the 68000, with a 32-bit operating system and several high level languages available — FORTRAN, PROLOG, BCPL, Cambridge LISP and Reduce (the Rand Corporation's LISP algebraic processor) available now, and Algol 68, Modula 2 and Pascal coming shortly. Darkstar is a single user, multitasking system, and for networking applications it already has Cambridge ring support, with Ethernet to follow. The basic system with 1/2 Mbyte of memory,

The Darkstar — not exactly your average desktop micro, is it?

one floppy disc, 40 Mb of Winchester disc, four I/O ports and two high level languages costs £11,000 plus VAT: Sirius Microtech Ltd, who market the machine, expect to sell about 50 a year to mathematical and engineering researchers and people working on Expert Systems.

Not yet available, but coming soon and on demonstration at the press launch, are high res colour graphics with light pen and supporting software. The demo I saw was pretty impressive, with the lower half of the screen containing one of those standard 3D 'raindrop on water' ripple plots and the upper half displaying an animated tetrahedral skeleton. The tetrahedron was rotating (flicker-free) about an axis inclined in both the X and Y planes of the VDU screen. (An even more explicit demonstration of the speed of the Darkstar was shown by a calculation, in LISP, of $2^{10,000}$. The computer took about 11 seconds to work this out, accurate to the last digit. The number filled about half of the 80-column screen when it was printed out.)

INDUSTRIAL ACTION

The reason why I'm writing about a computer way out of the price range of most people reading this magazine is that it's been designed at the School of Electrical Engineering of the University of Bath. The staff and students there developed it as a research tool because they couldn't find anything like it on the market to do the job they wanted at the price. The charter of the university shows that co-operation with British industry forms one of its roles, and so SML was set up specifically to exploit the R & D innovations that Bath produces. Furthermore, the operating system of Darkstar, TRIPOS, has been developed and in use at Cambridge University for the last seven years and can therefore be considered stable and reliable, with bugs extremely rare.

The advantages of an arrangement like this are many. The hardware is being designed and refined by the end users, so it should end up as an ideal piece of equipment (how many computers can you think of that never seem to have been actually used by the designer?). A similar story applies to the software; it's been in constant use by a large number of lecturers and students for many years (the LISP, also from Cambridge, has been running in this form since about 1975, and is nearly a foolproof implementation), so purchasers aren't going to be plagued by bugs. User-friendliness abounds: one command that the system supports is WHY, which gives a detailed explanation of what you've just done wrong. Ten out of 10, too, for supplying the OS source code.

Another advantage of this type of collaboration is that it helps break down the 'ivory tower' syndrome and prepare students for the 'real world', if close co-operation is required with industry. In the case of Darkstar, where Bath, Cambridge, SML and Motorola have established excellent working relationships, the benefits are obvious.

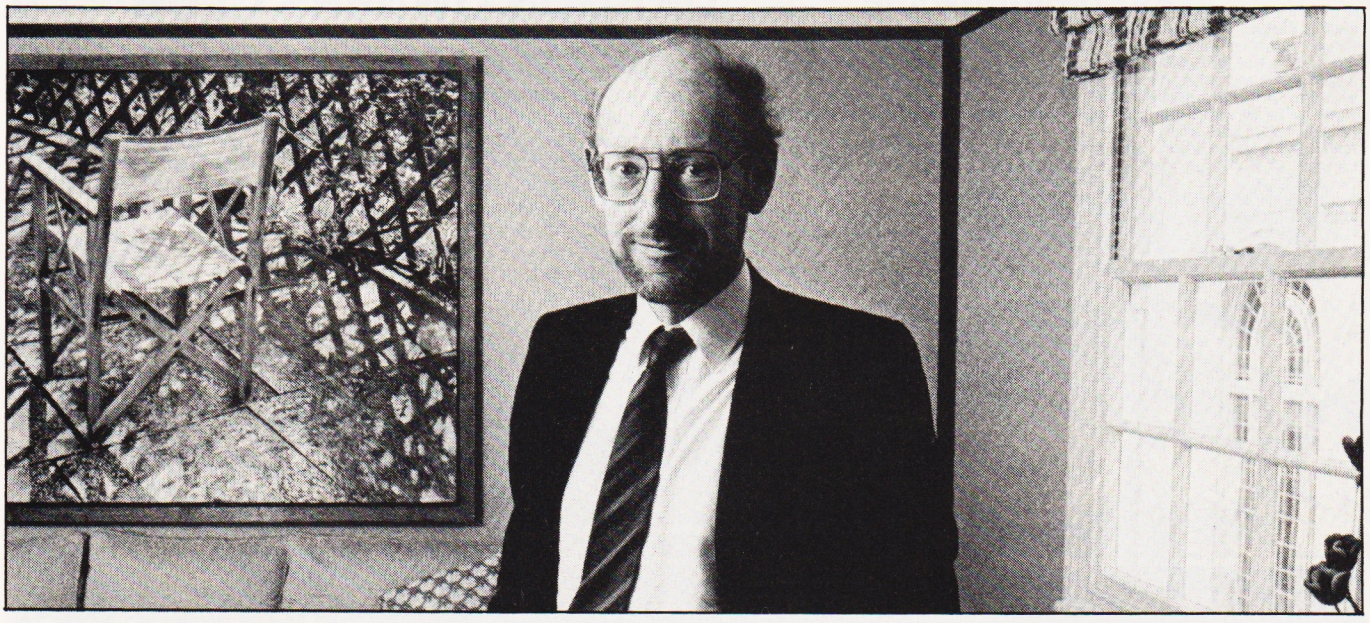
But most important of all, an arrangement like this allows the vast wealth of talent available among university students to be effectively tapped. In science and technology, the important work tends to be done before the age of about 25 (look at Einstein — look at Newton). Turning people of this age loose on R & D, at the peak of their enthusiasm, can hardly fail to produce superb work. One of the Bath lecturers was telling me over lunch that his problem is not getting the students to work, it's stopping them. The university is taking the top 90 students in each year from a list of 900 applicants, and the minimum entrance requirement is now two As and a B. That's a helluva research team! Other universities please note: if everyone did this, British industry would leave the world standing.

Any pools winners or research fellows with large grants who are interested in buying Darkstar or talking to SML about future developments can contact them at 15 Alexandra Way, Ashchurch Industrial Estate, Tewkesbury, Gloucestershire GL20 8NB.

Footnote: the software I saw being demonstrated had a nice touch of customisation which showed that the user knew the true role of computers. Instead of the abrupt and sullen 'READY' and 'OK' messages, the terminal was displaying 'I'm still listening, Master' and 'Your will is my command, Master'. Perhaps SML should have taken a leaf out of Oric's book and called their computer Slave!

KNIGHTTIME

To change the subject, the recent Sinclair knighthood has presented we computer journalists with a tricky problem of protocol. Is the correct form of address Uncle, Sir Clive, or Sir Uncle Clive?



Why is this man smiling? Something to do with a regal tap on the shoulder, perhaps...

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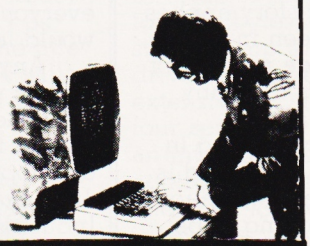

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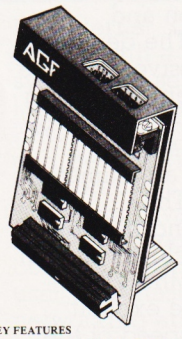

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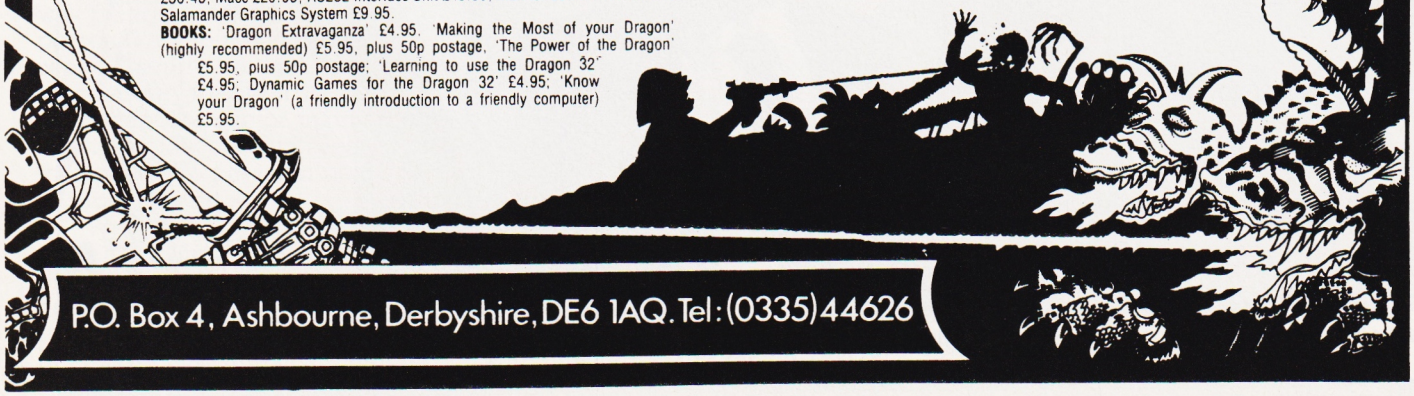

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A.J. Harding

THE TANDY HAT-TRICK

Tandy have been keeping a low profile recently. Suddenly, with a flourish, three new machines!

Two or three years ago Tandy were selling more Model Is than all of the rest of the microcomputer market put together. This leadership lasted for some time but slowly was eroded in the United States by the Apple and later the Apple IIs, together with the IBM, Commodore offerings and others. As the market grew, so Tandy's share, pro rata, decreased. They carried out one or two attempts at improving their position; one suspects, for instance, that the Model 16 was born of panic, since it was a modification of the Model II and, more to the point, released before any software was even a gleam in any author's eye. This, it will be recalled, was followed by the Model 12, about which somewhat similar remarks could be made. In there somewhere, Tandy released their colour computer which was extremely successful in the United States, but did not really get on its feet properly in the United Kingdom due to the multiplicity of low cost colour computers, both domestic and imported, against which it had to compete.

All of these goings on have rather reduced some Tandy watchers to a state of despondency. Others, who recalled the earlier days when Tandy would not even go on record to the effect that there was a single bug in their horrific TRSDOS 0.1, offered up prayers and took faith that Tandy must have something up their corporate sleeve.

It would seem that such faith has been justified because Tandy are now hitting the market with three new machines, at least one of which is revolutionary.

I think I probably fit within the category of those who had faith and so it was with great pleasure that I was able to take delivery of pre-release versions of these three machines. All of them (with one possible exception) have given me a great deal of satisfaction.

The three machines in question are the Model 4, the MC10 Micro Colour computer and the Model 100. The latter, of course, has been described in the US press for some weeks. The Model 4 is starting to be reviewed over there, but curiously enough the MC10 seems to be (as of this writing in early June), still under wraps.

MODEL 4

For some reason best known to the hierarchy in Fort Worth, Tandy have broken tradition with the name of this machine; Arabic figures are now used rather than Roman. This seems a pity; one rather got attached to the capital I after the model name, and Model 4 sounds much more mundane!

The Model 4 is an extremely attractive machine physically: it looks somewhat like a white Model III. The additional white keys seem to be made of some 'super-white' plastic, so the overall appearance is of an ivory case with mostly black keys, but some bright white.

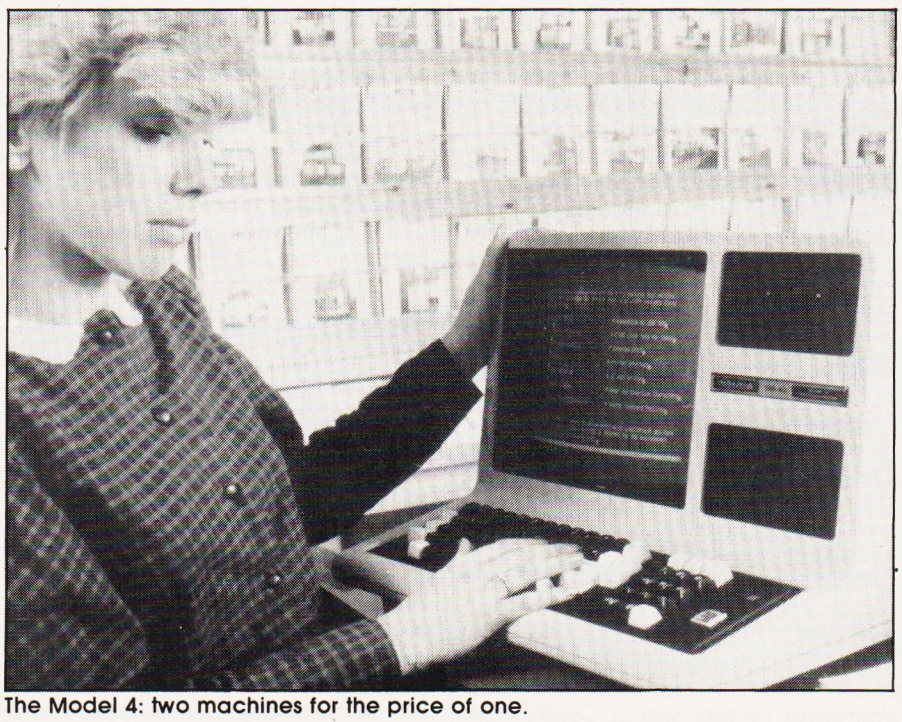
In the United Kingdom all screens will be green; an optional extra in the United States. There are a number of display options depending what mode you are in. The two basic ones are 80 by 24 and 64 by 16, but additionally one can have double width characters, producing 40 by 24 and 32 by 16. The effect of this is rather nice.

Compared to the Model III the keyboard has five extra keys. Three are programmable function keys; but I have not yet worked out how to program them! An addendum to the manual states that F3 will erase the last character, F2 will leave the Insert Edit mode and F1 will pause program execution. None of these seem to function for me and I could not find anywhere in the manual to tell me how to program them for my own applications — apart from the normal way of intercepting the code generated by them.

The two other additional keys are a Control key and a Caps key. These work well and are very welcome. Hitherto, on the Model III, one has had to press the Shift and the zero key to get the effect of the Caps key, and the Shift and down arrow key to get the effect of a Control key.

Various configurations of the machine will be available: probably the usual will be two drives and 64K, while another alternative is 64K and one drive. All drives are 40 track double density. There is also a 16K cassette based system, though I haven't seen one of these.

The only real differences bet-



The Model 4: two machines for the price of one.

APPEND	ATTRIB	AUTO	BUILD
COPY	CREATE	DATE	DEBUG
DEVICE	DIR	DO	DUMP
FILTER	FORMS	FREE	LIB
LINK	LIST	LOAD	MEMORY
PURGE	REMOVE	RENAME	RESET
ROUTE	RUN	SET	SETCOM
SETKI	SPOOL	SYSGEN	SYSTEM
TIME	VERIFY		

Table 1. Model 4 library commands.

BACK-UP	COMM	CONV	FORMAT
LOG	PATCH	REPAIR	TAPE 100
BASIC	CLICK/FLT	DOM/DVR	FLOPPY/DCT
FORMS/FLT	DAM/FLT	MEMDISK/DCT	

Table 2. Model 4 utilities, drivers and so on.

ween the Model III and the Model 4 are defined by the operating system used. As a tape-based machine does not have a DOS, it is difficult to see how the tape Model 4 will differ from the tape Model III.

In terms of compatibility, the Model 4 is indeed a giant leap for mankind. Until now, both the software vendor and his customer have had endless difficulties regarding the compatibility of succeeding machines in a particular range (and not just with Tandy machines). The Model 4, however, is a new concept for Tandy. It is, in fact, two machines in the same case. What is even better is that the user does not have to issue any commands, switch any switches or do anything else other than insert an appropriate disc in order to decide which machine is going to be powered up. If you insert a Model III DOS disc into Drive 0, then the machine becomes a Model III. It is not a question of compatibility, it ***is*** a Model III. The Model III ROM is present and any software written for the Model III will operate on the Model 4 in this mode. The machine automatically takes care of the display mode; a Model III disc will cause 64 by 16 mode to be automatically chosen.

This is a very big plus for the machine. In order to run your present Model III applications programs, simply put in your Model III disc operating system and low and behold, you are staring at a Model III.

Things get a little more complicated when the machine puts on its other hat, that of a Model 4. In the Model 4 mode, you are automatically put into 80 column by 24 line display mode. What happens after that depends entirely on what you wish to do, for the machine is 'blank': it contains no interpretive BASIC. Hence it can run CP/M, and Tandy will be issuing their own improved CP/M 3 shortly, written for them by Digital Research. What comes with the machine is a disc operating system which Tandy call TRSDOS 6.0. It is in fact LDOS 6.0, written by Logical Systems and licensed to Tandy.

Another difference between the Model III and the Model 4 modes is the speed at which the processor runs. To retain compatibility with Model III software, the clock must run in the Model III mode at a speed of 2 MHz. In the Model 4 mode, however, the speed is doubled to 4 MHz.

DISC OPERATING SYSTEMS AND BASIC

In Model III mode the question of DOS is up to the user. As far as I know, all major DOSs available for the Model III will operate without any changes or trouble. I personally tried TRSDOS 1.3, LDOS 5.1.3, DOSPLUS 3.3 and MULTIDOS. I did not notice any difference at all over the Model III.

The TRSDOS or LDOS 6.0 is, essentially, a RAM-based LDOS 5.1.3. Some things are lacking, a few things have been added. A complete list of the Library commands available are shown in Table 1. Utilities, filters, drivers and languages are shown in Table 2.

Present LDOS owners will recognise the majority of the contents of these tables. Some need individual mention, for both good and bad reasons. On the asset side is the inclusion, without extra charge, of MEMDISK: a driver controller which enables the creation in RAM of a 'disc drive'. In the Model III version (which is not supplied on the Model 4) it finds most of its users amongst those who have single drives. By remaining in DOS (in other words not calling BASIC), quite a reasonably sized drive can be constructed. This makes single disc operations much more convenient. In TRSDOS 6.0, of course, with the ability to expand the machine up to 128K, MEMDISK really comes into its own, for not only do you get the added convenience of another drive when MEMDISK is installed, you also get the speed increase of direct access to the contents of your pseudo disc drive. This can produce some really astonishing increases in speed, better even than those obtained by a hard disc drive.

On the minus side, I think we must put the CLICK filter. I suppose I have come across more useless things in a computer at some time or other, but it is hard to remember them. The supposed effect of installing this filter is that every time a key is depressed, a distinct click is heard from the sound output of the machine. Perhaps I have a bad specimen of the hardware, but what comes out of my machine is a rather half-hearted squeak, the effect of which is to make one reach for the oil can rather than anything else.

The COMM utility is very similar to LCOMM in 5.1.3. The TAPE 100 utility establishes transportability with the Model 100 machine, described below.

Turning to the Library commands, the KILL in LDOS 5.1.3 has been replaced by REMOVE. FORMS is somewhat similar to the utility of the same name in the Model II; it enables you to set up various parameters for your printer. SETCOM is also similar to the Model II utility. In this case the RS232 is being set up. SETKI enables the user to change the repeat values of the keyboard driver. A nice Spooler is included. The SYSTEM command has been changed quite considerably: about 12 of the old parameters are retained. SYSGEN, incidentally, has been moved out of the SYSTEM command and been given a command of its own. In other words, to store current system options, one has to type SYSGEN with various parameters rather than SYSTEM (SYSGEN). Existing LDOS users will be happy to hear that the Job Control Language is retained in 6.0.

It would be hard to criticise 6.0. It has retained at least 80% of the most used features of LDOS 5.1.3, and Logical Systems intend to license a number of versions of LDOS 6.0 for various RAM-based machines. The only serious criticism that I have is that 6.0 does not appear to reflect the higher clock speed in the running of the system. Some functions are definitely a lot faster, but some are not.

The most serious criticism that I have of the Model 4 is its BASIC. I think Microsoft are to be criticised most strongly for lagging so far behind in the convenience features of their BASICs. In the last few years, we've all become used to the enhanced convenience features put

into the original Disc BASIC, starting with NEWDOS + and going all the way through to LDOS 5.1.3. I am heartily disappointed that this BASIC has effectively gone back to square one. Indeed, Microsoft seem to have set out to design this particular dialect of BASIC by making it as user ***unfriendly*** as possible. For a new user the difficulties will not be apparent, but those of you who are used to Microsoft BASIC on the Tandy or Genie machines (especially when the interpreter has been increased by the addition of a disc BASIC from a DOS such as NEWDOS +, NEWDOS 80, LDOS, DOSPLUS and so on), will go through a number of cursing sessions before they get used to this new dialect.

Let me make it clear, the differences are not (with one or two minor exceptions) in the statements and functions; these remain essentially the same. But we have all got used to using E for EDIT and L for LIST, a comma to edit the last line and so on, particularly those of us who are addicted to using the arrow keys to reach the first, last preceding and following lines of a program. Most important of all, unlike all of the prior Microsoft BASICs, this dialect is distinctly unfriendly on the subject of blank spaces. For instance, in all previous versions the command line LIST10 would display line 10, assuming that there is one. On the Model 4 it will give you a Syntax Error. In the program itself GOTO1000 will not work, GOTO 1000 will. The present experienced user is going to get so many error messages that it is perhaps nice that these are carried in the machine — in other words, on the first error a module is not brought in from disc.

There are no CMD conveniences, or rather there are very few. CMD itself has been replaced by SYSTEM, as in the Model II, and it is possible to add some disc operating system commands. Thus SYSTEM "DIR" will work but some other DOS commands will not. Gone are the CMD Break key disablers, debugger entrances and machine language program loading from BASIC. One almost cries for the lack of the CMD "O" sort and the CMD "X" cross reference utility. It is difficult to know why these have been scrapped. In the directory of TRSDOS 6.0 one sees the familiar LDOS BASIC Overlay file number 1, which contains the Renumber utility (which is included) but not the other two overlays to enable the cross reference and sort. One supposes there must be a technical reason for this rather serious omission. On the other hand it seems reasonable to argue that if the first overlay could be included, why not the other two?

In all of these serious drawbacks there are one or two small pluses. First of all, the command WHILE...WEND is included. This is a useful function. It is a very similar to the FOR/NEXT loop which, of course, is also included: the difference is that the loop count is checked at the beginning of the loop rather than at the end. One can exchange values of two variables with a SWAP command. The TRON command is still as impossible to use as ever, inevitably covering the screen with line numbers just when one does not need them. Why don't Microsoft keep the line number report on the top line of the screen? The WRITE and WRITE # commands will respectively print data on the display and write data to a sequential file.

A CHAIN command is included, which is definitely an improvement. There are probably one or two other small changes that I have missed but if, as I suspect, most people will not consider the WHILE... WEND of any great importance, then effectively one is trading-off all of the user conveniences to the CHAIN command. I suppose it is a subjective judgement, but in my book that is a very bad deal.

DOCUMENTATION

The documentation is not up to the normal standard of either Tandy or Logical. Probably the biggest omission of the TRSDOS section is the complete lack of information on the Supervisory Calls. I do not wish to criticise the manual too heavily because it is certainly acceptable. However, one is in a permanent state of uncertainty when using it.

It is, of course, a large manual, as indeed it should be for such a machine and it may be that I have missed parts of it or have not used it correctly. I have still to find what to do with those function keys, however!

TO BUY OR NOT TO BUY

The answer to this one depends entirely on whether you have got a Model III already. If you have and you have only a small interest in CP/M, then don't bother. If, on the other hand, you are thinking of buying a Model III now or in the future, or have some interest in CP/M, then it is a beautiful machine. I personally find the BASIC very disappointing indeed. This is neither the fault of Logical nor Tandy, however, although I suppose one can blame the latter for choosing their vendor.

THE MC10

A review of the MC10 has to be approached rather cautiously because the machine is a very similar size to the ZX Spectrum/Oric type machines. It would be very dangerous to compare the two, for it's my guess that when the MC10 was designed, Tandy had probably never seen any of these smaller English machines.

At any rate, the point must be made that, even though they are of similar size, the MC10 is not intended to be a competitor for the ZX Spectrum or the Oric.

The MC10 is exactly what its first two initials say, name a Micro Colour computer. It is very small, and sells at a very low price. In the United States it is selling at around $150 to $160, so I suppose Tandy over here will probably be trying to retail it at just under £100.

The MC10 is not really a Spectrum/Oric competitor.

The first thing that strikes you about the MC10 is that, like all of Tandy's equipment, it is very well built. It is nice and solid and made of a good quality plastic. The keyboard is a normal type in the sense that it has real keys – not a membrane keyboard. When pressed, the keys give a satisfying click. The MC10 measures 8¾" long by 7" deep overall. At its highest point it is 2" high off the desk, going down at the front to about 1⅜".

The keyboard is a standard QWERTY. Sixteen graphics characters can be typed by using the Shift key and there are 38 single key entries via the Control key for the most commonly used BASIC commands. The Control key is also used for the four arrow keys. There are two outstanding criticisms to be made of the keyboard layout. The first is that there is only one Shift control and unfortunately it has been put on the right hand side of the keyboard. It is my experience that most people tend to use the left hand key when two Shift keys are included. To make matters worse, what would normally be the second Shift key on the left hand side is actually the Control key. When using the MC10, then, I almost continuously used the Control key thinking it was the Shift. Control sets the single keystroke mode, so when shifting to get the question mark as the abbreviation for the PRINT command, for instance, more often than not I would get the single keystroke command, which happens to be SQR! The other criticism is that, in order to delete the last character, one has to use the left arrow. I am afraid I frequently have to delete the last character or characters and found it something of a chore to have to use the Control key to get the left hand arrow every time. It would have been far better to have made this arrow key accessible without using either the Control or the Shift key.

The MC10 comes with 4K of RAM. An expansion port at the back of the computer will enable this to be increased. Tandy as yet are not willing to commit themselves on how much. The display is 32 characters wide by 16 lines. Tandy's manual is a little coy about the other specifications of the machine — unfortunately, a memory map is not included so one doesn't really know how much ROM there is. I would guess that it's a 12K ROM. An interesting inclusion is that of an RS232 interface: this is actually for driving a serial printer.

The MC10 can generate nine colours, namely black, green, yellow, blue, red, buff, cyan, magenta and orange. The default background colour is always green. The graphic characters are printed in the various colours by adding numbers to the CHR$(n) number. Thus, if you are printing character 129 in, say, red, then the statement would be PRINT CHR$(129+48).

ABS	ASC	CHR$	CLEAR
CLOAD	CLOAD *	CLS	CONT
COS	CSAVE	CSAVE *	DATA
DIM	END	EXP	UP ARROW
FOR/TO/STEP/NEXT	GOSUB	GOTO	IF/THEN
INKEY$	INPUT	INT	LEFT$
LEN	LET	LIST	LLIST
LOG	LPRINT	MEM	MID$
NEW	ON...GOSUB	ON...GOTO	PEEK
POKE	POINT	PRINT	PRINT TAB
PRINT@	READ	REM	RESET
RESTORE	RETURN	RIGHT$	RND
RUN	SET	SGN	SKIPF
SIN	SOUND	STOP	STR$
SQR	TAN	VAL	

Table 3. MC10 reserved words.

THE LANGUAGE

The BASIC interpreter is pretty well standard Microsoft; unfortunately, it does not contain Edit functions. Indeed, I found this to be one of the most annoying drawbacks of the machine. As will be known, there are two methods of editing on microcomputers; either with a line editor as on all other Tandy machines, or with a screen editor as on Commodore and other microcomputers. The MC10 does not contain either. You can backspace with the left hand arrow and this erases the last character. There is also a command for line deletion, though the purpose of the latter rather escapes me. I suppose you save a keystroke or two but, of course, you can delete a line simply by typing the line's number. Anyway, for what is worth, the line deletion key is reached by pressing the Control key, and so far as I can see that facility plus the left hand arrow is the sum total of the Edit function. Obviously one has to give up quite a lot, when one miniaturises not only the machine but also the price. It seems a pity to have omitted even a rudimentary screen editor.

The reserved words are shown in Table 3. As you can see, it is a generous interpreter. Most of the commands and functions should be familiar. The SKIPF will skip to the end of the next program on a cassette tape or to the end of a specified program. The inclusion of PEEK and POKE is a welcome surprise: a number of restricted interpreters do not include these essential commands for machine language programming. Of particular interest are the commands CLOAD * and CSAVE *. These will load or save numeric data into or from an array, on to cassette.

The SOUND command is nice and simple to use compared to the larger Tandy Colour machine and the Genie Colour. Only two parameters are specified, tone and duration, each being a numeric expression between 1 and 255. Each unit of the duration number is equal to approximately 75 thousandths of a second.

The great strengths of the MC10 are that Tandy have not gone the route of a membrane keyboard but have miniaturised a full size keyboard; they have not gone the route of cheapening the package, nor the quality of the electronics.

Of course, as the reader has doubtless realised, the great omission is colour and graphics commands. This is really why it is unfair to compare the machine to a ZX Spectrum-like microcomputer. The MC10 does not pretend to be high resolution, nor does it offer any of the extended colour commands of its big brother, the Tandy Colour Computer. It is essentially what it sets out to be, a miniature colour machine with all of the advantages and disadvantages of such a piece of hardware.

THE MODEL 100

The Model 100 is a fascinating and, to a large extent, unique offering from Tandy. Its closest competitor is the Epson HX-20: this is hardly a competitor, though, because the 100 has a liquid crystal display some three or four times bigger than the Epson's.

The 100 is a truly portable machine. It measures 11⅞" long by 8½" deep and 2" high. It weighs 4 lb and can, therefore, be carried quite comfortably in a reasonably sized brief-case. It has a full-sized QWERTY keyboard and has a very pleasant feel, the keys giving a distinctive click when they are depressed. A number of non-alphanumeric keys are supplied, including Escape, Control and Caps Lock. There are three other special

keys along the bottom row of the keyboard. On the left is GRPH and on the right CODE and NUM.

The Code key generates foreign language letters and accents. The specimen that I have was shipped from the States; hence I will not go through the foreign letters available because they may well be different on the UK model. The GRPH key generates a set of graphics in conjunction with the Code key. The Numeric key is unique; it converts the U, I and O keys to 4, 5 and 6, the J, K and L keys to 1, 2 and 3, and the M key to 0. In other words, the Numeric key converts a set of nine keys into an imitation numeric pad.

I think I am right in saying that the liquid crystal display is the largest available on a microcomputer – eight lines by 40 characters. Interestingly, the machine supports dot addressable graphics of 64 rows by 240 columns. Very interesting effects can be obtained with this feature.

Apart from the size of the display, however, what attracts me to it is a little dial on the right hand side of the computer. Moving this alters the visual angle of the display electronically, thus not only making it easier to read, but also circumventing the problem one often gets with LCD when it is at a particular angle to the light source.

Between the display and the keyboard is a set of 16 thin keys set out in four groups of four. Twelve of them are special purpose keys, eight of these being programmable. The bank on the extreme right are the four arrow keys and, of course, control the cursor. The four special purpose keys in addition to the user definable ones are Print, Label, Paste and Break. The Print key sends the screen to the printer; Label displays on the bottom line of the screen the functions to which the eight function keys have been defined; Paste is used with the Text Editor.

The normal Centronics-compatible parallel printer port is available, as is an RS232. Behind a small door in the bottom of the machine is an expansion bus, plus a ROM socket for additional software which Tandy will be issuing.

The CPU runs at 2.4 MHz and is, therefore, roughly similar to the Model III. The machine comes in two memory configurations, 8K and 24K RAM: there is a 32K ROM. This, as its size will intimate, contains more than just the BASIC Interpreter.

SOFTWARE/FIRMWARE

What makes the Model 100 unique is not only the large display, but also the software written into the 32K ROM. This consists of a Microsoft Extended BASIC, a limited but easily usable word processor, an appointment scheduler, communications package and address handler. As all of this software was written by Microsoft it is, to a certain extent, interactive. I do not know how much of the ROM is taken up by the interpreter: to a large extent it is similar to the interpreters in previous Tandy models, but there are quite a few new keywords. Some of them, of course, are only of import to the communications package. For instance, one can define a communication interrupt and use the command ONCOMGOSUB. A similar command is available for a modem interrupt and, for that matter, a time interrupt.

I particularly like the simple word processor in firmware. A number of people nowadays, particularly businessmen, carry miniature electronic typewriters around with them. Most of these, of course, include a form of text editor, but the one in the 100 is far better. More to the point, it has a large screen: hence, it is very easy to use the word processor to produce letters and documents.

The Schedule program is essentially a simple data base manager, as to a large extent is the Address program. A nice idea is that RAM is partitioned into RAM files – the maximum is 19 on a full computer. Programs or files are called by positioning the cursor over the appropriate name on the screen and then hitting the Enter key. On first power-up the machine shows the programs in memory. For instance, on an 'untouched' machine the screen will come up with BASIC, TEXT, ADDRSS and SCHEDL, and you choose which one to use. This is a very neat way of accessing programs and files.

The manual is up to normal Tandy quality, although it does exhibit the Tandy habit of missing out one or two items of information. However, one can say this about pretty well any microcomputer manual. In view of the environment in which it is supposed to be used, it is very convenient that the manual is spiral bound so that it lays flat on the knee.

Surprisingly, the manual does not contain any sort of tuition on BASIC. If the machine really is aimed at the businessman, or as Tandy say "as an executive work station", then a few pages of 'BASIC tuition would surely have a place. Even so, the Model 100 is a super little computer.

The portable Model 100 – a real computer in your briefcase.

Model 4, 16K, cassette-based:	£749
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MC10: Not yet available	
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Table 4. Prices for the new machines.

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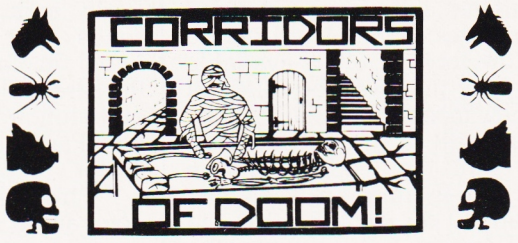

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Here are descriptions of just a few of the games:

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CORRIDORS OF DOOM! A dungeons & dragons type game that is very addictive. You can never win this game by chance. A lot depends on discovering the secrets of just how you have to deal with each individual monster in the game. There is a liquid which will destroy the Werewolf — but which one? How can you tame the giant spider? Will you ever learn the secret of how to defeat the Blood Devil? All of the monsters have treasures for those who are both brave and wise enough to overcome them, but to escape alive you must first cross some very nasty pits. Play it again and again.

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3D NOUGHTS & CROSSES Played inside a 4x4x4 cube, this is a game for the intellectual. Great graphics. It plays a mean game and wins about nine out of every ten games it plays.

TOWERS OF HANOI You will welcome this classical puzzle which is a must for anyone with a computer. The problems difficulty depends on how many disks you use. It might only take you a few minutes with four disks, but with all nine it could take all day. Two variations of the game are included. There is a constant display of Hours : Mins : Secs, so that you know how well or how badly you are doing at any particular stage. If you find you cannot work the problem out! The computer will show you the shortest possible solution.

THE VAULT A high security vault in Oxford. (The game can be changed to centre around your own home town) has ten doors, each with its own five figure combination. The combination of the nine inner doors are known, but only the manager knows the combination of the outer door. Unfortunately the manager has got himself locked in the Vault. It is your job to get him out before all the Oxygen is used up. The computer will give you metaphorical clues to how near you are getting. The time switches which change the combination every so often can prove a problem. This is a case which really puts your powers of logic to the test.

POPULATION SIMULATION This is a game for two players, each becoming the leader of one of the planets 'Techno' & 'Primo'. It is a battle to survive. Each decade a player must decide various things in governing his planet. he must carefully balance production and technology against consumption and population. He can either negotiate with his opponent or declare war on him. How about sending out an exploration party in search of new wealth. Only the experienced last very long.

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Dear Sir,

The review of the Computers Lynx in your June issue, despite being very thorough and a good piece of work, was a trifle unfair towards this micro. In particular, the reviewer says of the standard 48K machine that "There is no question of trading screen resolution for working RAM. The present machine has 16K of working RAM".

In fact, it is possible to use about 32K of RAM for programs, and I enclose one of Level 9's 32K adventure games to prove it.

The extra memory cannot be used for BASIC, but is available to machine-code programs without too much trouble — I suggest that interested owners contact Computers (and not Level 9, please) for information.

Yours faithfully,
Pete Austin,
Level 9 Computing

Dear Sir,

I feel that I must comment on your review of the Lynx in the June issue. One major inaccuracy is in the reviewer's description of the memory map. The workspace RAM is not doubled from 16K to 32K as stated. It is quadrupled to 64K by replacing eight 4116 RAMS with 4164 chips and changing a few links (groan!) on the PCB. I have successfully carried out this upgrade, giving myself 38526 bytes free for BASIC. The reason for this number is that 24K is overlayed with the ROMs, and therefore unusable without deselecting them. This in fact is what would be required to implement CP/M — the ROMs are switched out and the DOS is booted up in the 64K of RAM that becomes available. It is therefore not necessary to add a third bank of RAM, as presumed by the reviewer.

I would also like to take issue with your statement that the Lynx does ". . .not meet the published specification in full." Come off it — what micro does everything that the adverts say? Consider the Oric-1 — the brochure for that machine claims the existence of DOUBLE, FLASH and INVERSE commands, none of which are actually present on the machine. Then there is the BBC Micro — how long did it take Acorn to bring that up to its published specification by the introduction of OS 1.2? However, your reviews of the Oric-1 and BBC (admittedly not written by the same people) failed to mention these facts. In this respect I feel that you have been rather harsh on the Lynx, especially as the Oric-1 and others have more serious bugs in their firmware. Having said this, I must agree with everything you say about documentation and quality control.

Use of a logic probe reveals that the Break key is connected to the INT pin of the Z80A. As the operating system disables interrupts, it is not surprising that Break does nothing. However, executing the assembly language instruction EI results in an interrupt being generated — without Break being pressed. Do I have a dodgy pull-up resistor?

Would anyone interested in forming a national user group for the Lynx; if so please write to me. I will be pleased to write hardware and software articles, write programs and evaluate software contributions. However, I would like others to handle newsletter distribution and general administration.

Your faithfully,
C. Cytera,
30 Wellington Drive,
Harmans Water,
Bracknell,
Berkshire RG12 3NG.

(* Don Thomasson replies: The advertised memory capacity of the Lynx is 192K, which implies three 64K banks. Within this framework, a number of arrangements are possible, including the one stated in the review and the one Mr. Cytera outlines. Whether this arrangement would meet the CP/M requirement would need to be checked. At the time the review was written, the use of a third bank was under active consideration, since that looked like a preferred solution.

It is agreed that few recent computers have met their stated specifications in full. Is there any reason to conceal that fact? Lynx owners have said that the machine was let off lightly, not treated harshly, but there seemed to be no point in going into every last detail. It is perhaps unfortunate that other machines have been reviewed even more leniently, because that could mislead members of the public, but covering every aspect of performance can take quite a time. The Lynx review involved about three months of study. That seemed worth while, because the concept of the machine is very good. When the implementation is equally sound, the Lynx could be very good indeed.

With regard to the Break key and interrupt, it can only be said that no interrupt mode is set, so the default interrupt mode applies. If an interrupt has been called at any time between a disable and an enable, it will be executed at the end of the instruction following the enable. It is therefore useful to call disable just before enable, clearing any outstanding interrupts *)

Dear Sir,

*I have read your review of the Hobbit, and have also used one for about a month. First, Control B and Control C work perfectly all the time. I use the parallel port and Epson FX80. Ikon have replaced the operating manual as they said they would. The new manual is a neat, spiral-bound booklet with a red cover printed on good quality paper. It devotes a page to each * Command, and describes all the error messages (eg Checksum) and what action to take to correct cause of error.*

In operation, it is simple to use and very reliable. In the time I have used the Hobbit it has never failed in saving or loading programs or files. It has been used for sequential files, relative files, the updating of files by reading from one file and writing to another. The APPEND instruction works every time; I tried the Append 10 times on one file without any error. I have also used the Append with Wordwise, joining work typed on different occasions.

Because of the ease of Saving/Loading, my use of the computer has increased; I now save everything and anything knowing that the Hobbit takes care of finding the program or a space for a program. With regards to the loss of memory, Ikon are to produce a small sideways RAM module so that no user memory need be lost for the buffers of the Hobbit. As for the solid black ▶

metal case of the Hobbit, if you want an ornament you will be disappointed, but if you want a good versatile reliable system you will be satisfied.

Yours faithfully,
J. Smithe,
Bradford

Dear Sir,

Thank you for your review of the HOBBIT floppy tape system for the BBC. It was very fair, considering the equipment we lent you, but I wonder if I may bring your readers up to date on the current system.

1) The manual with which you were supplied was a provisional one. I enclose a copy of the current manual, which has now been sent out to ALL purchasers of the system. I hope you agree that it is a big improvement on the original. Our feedback from customers has been positive.

2) The current version of the operating system does NOT have the difficulty you mention with control-B and the printer. I have personally tested this out on version 0.1 of the operating system in BASIC and version 1.2 using BASIC, WORDWISE and VIEW.

3) The real time clock is NOT corrupted as you say. It merely stops while the HOBBIT is running. The data line to the cassette has to be toggled at intervals of 160-320 microseconds. To do this it is necessary to disable all internal interrupts. You are correct in saying that this ought to have been pointed out in the manual.

4) The only problem of any consequence which we are having at the moment is a slight incompatibility with the word processor VIEW (WORDWISE functions perfectly). We are publishing a patch which overcomes most of the problems, although LOAD still does not function. This is easily bypassed by using NEW followed by READ. Everything else seems to work when the patch is used. This letter was written using VIEW. We are still working on the problem and hope to come up with a complete solution.

5) We hope to release our "ZERO-RAM" option towards the end of June. This provides 4K of RAM paged with the ROM so that you can have a fully operating file system with two drives and three buffers and still keep PAGE at &E00.

6) You mention possible competition in the form of 3½" disc drives. It is worth noting that it costs £100 to have the disc interface fitted, before even thinking about the drive itself. If anyone has a high speed storage system that can be run from a user port then I suggest they contact us. We can offer a very good operating system to drive it.

7) Fitting of the HOBBIT has been simplified. Current ROMs are able to operate at 2 MHz and this removes the need to change any links or cut any leads. There is not much we can do about making it easier to plug a chip in!

I hope that covers most of the little points that you say "niggled" you. As you know in this line of business it is almost impossible to get things right first time. Acorn released the BEEB with bugs in the cassette operating system, Sinclair had bugs in the ZX81, and need I mention Oric-1 or Lynx.

Yours faithfully,
L. J. Want,
Co-author of the HOBBIT Operating System.

(* Henry Budgett replies: I am saddened to see that your new manual contains no diagrams at all! While the text is, in some cases, an improvement, the lack of any decent illustrations cannot exactly be described as a great step forward in user documentation. The warning to turn the BBC Microcomputer off before fitting the HOS is still missing, a message that should be printed very clearly on the first page!

The comment I passed on the status of the clock being corrupted still stands. If you stop a real-time clock while an HOS command is being processed, the clock will not hold the correct time when that process is finished. Its contents are, therefore, corrupt.

My view on the possibility of attaching 3½" discs was, and still is, that while these are obviously going to be more expensive they do allow access to a 'standard' operating system environment. You do not have to instal the DFS circuitry to attach discs, they can be accessed through any port. Admittedly they will be slower because they cannot perform DMA but they will still operate, given suitable systems software. *)

Dear Sir,

In reply to the difficulty encountered by N.J. Fitten (June 1983) in saving/loading programs from/to the Casio FX-702P, the problem is almost certainly due to the high input impedance presented by the calculator.

Portable cassette recorders are primarily designed to drive loudspeakers of at most a few tens of ohm impedance. The output amplifier of the recorder is usually isolated from a direct connection to the loudspeaker by means of a capacitor which has to have a high value of capacitance to enable low audio frequencies to be reproduced. Invariably, an electrolytic capacitor is used which unfortunately characteristically means a small polarising current flows into whatever is connected to the output. If this happens to be a high input impedance calculator, a DC voltage is produced which can prevent the calculator from distingushing between the high and low states used as digital information.

The cure is to place a resistor between the output and the earth connection, of a value of about 470 ohms, best soldered inside the recorder. I made this modification to my son's FX-502/FA1 cassette recorder combination which now works perfectly. If Mr. Fitten is not able to make this modification himself, a repair shop should do so for a small charge.

Yours faithfully,
S. F. Clarke,
Chelmsford

Dear Sir,

Just a brief note in objection to your July cover. Thus far most computer firms on all sides have managed to steer clear of sexist, oppressive material. Hopefully you will do the same! If not, then be assured that I am one reader who will stop reading.

Yours faithfully,
J. McLae,
London N1.

Dear Sir,

I buy **Computing Today** *every month and so far have enjoyed reading a magazine that gives information in interesting, comprehensive articles with humour.*

However, I was deeply offended when I saw the cover of the July issue. It is sexist and degrading to women — an aspect of journalism that I had not identified in your magazine until now.

As a teacher of Maths and Computing, how am I to successfully convince girls as well as boys of the importance and relevance of this part of the curriculum? As long as magazines such as yours continue to present girls and women as attractive sexual accessories to

technological progress, it's no wonder that girls feel they have no real part to play in it. Don't you feel you have a responsibility to incite interest in, and enthusiasm about, computing in ALL members of society?

Yours faithfully,
Alison McMichael,
Shepherds Bush.

Dear Sir,

With regard to the cover of your July, 1983 issue of **Computing Today**, *I feel required to comment on the unsuitable nature of its design. Surely there is a more appropriate and acceptable method of introducing the topic of 16-bit microcomputers than that which was employed.*

The use of a uniformed schoolgirl as focal point on the cover was an unconscionable abuse of the most blatant variety of sexism in advertising. Perhaps the garter, nylon stockings and pointed bra were meant as a joke, to act in counterpoint with the multitude of phallic symbols (unsheathed (!) lipstick, enlarged (!) interface plug and baseball). It may have been the artist's intention to denigrate **both** *sexes; this does not in any way compensate, however, for damage done to women by the representation of young womanhood on the cover. Your readers do not profit by this exploitation of women as sex objects, and you do your magazine incalculable injury by encouraging an association with unacceptable and insupportable attitudes.*

Yours faithfully,
Dr. K. Sterling,
School of Management,
Leicester Polytechnic.

(*That makes it unanimous, then — I didn't like the cover either. Or last month's. Unfortunately I joined CT too late to make any changes: I can only apologise for any offence caused and assure readers that it won't happen again — Ed. *)

Dear Sir,

A study of the Osborne 1 keyboard will reveal that there are some gaps in the ASCII character set, though all may be displayed. A little investigation reveals that the gaps may be filled by using the Control key in unlikely places. The characters I have found are listed below. Delete is particularly useful when using the Osborne as a terminal, as some computers use this rather than backspace to delete the last character on input.

Yours faithfully,
A. David,
Canada

```
Key       Char      Hex
^=        `         60
^,        {         7B
^.        }         7D
^/        ~         7E
^?        <DEL>     7F

( This is control-
shift-/ )
```

Dear Sir,

Many thanks for your article on the Jupiter Ace. It prompted me to buy one and I certainly haven't regretted it. I recommend it to anyone who doesn't know FORTH and would enjoy the stimulating challenge of learning it. By the way, does anyone out there know where I can get more information either about FORTH or about the Ace itself?

Yours faithfully,
Andrew Keen,
Southampton

Dear Sir,

Owen Bishop's review of the Jupiter Ace (May 1983) was, I thought, well written and fair to the machine. Unfortunately, in his last section he was less than fair to the FORTH community; there is a viable and thriving body of enthusiasts both at the FORTH Interest Group and here at COMSOL. The FIG secretary is Keith Goldie-Morrison at 15 St Albans Mansion, Kensington Court Place, London W8 5QH.

I must also take this opportunity to correct the book title you quoted; the publication by Tom Hogan is actually entitled **Discovering FORTH**', *and I agree it is of indifferent quality. COMSOL, being a major vendor of professional FORTH systems, stocks a few books that we consider to be the best currently available as follows:* **'The Complete FORTH'** *by J. Winfield, Wiley & Son 1983; low cost, simple;* **'Starting FORTH'** *by L. Brodie, Prentice Hall, 1982; best all-round textbook:* **'Threaded Interpretive Languages'** *by R. Loeliger, McGraw-Hill, 1981; for the systems person.*

More information is available by calling COMSOL on 09328-65292 or by contacting FIG.

Yours faithfully,
N. L. Vine,
Director,
Computer Solutions Ltd

Dear Sir,

I read D.S. Peckett's article on FORTH with interest, but I was surprised to find no mention of Extended Fig-FORTH from Atari under systems available. Extended Fig-FORTH (APX 20029 on disc) is a full implementation of Standard Fig-FORTH as defined in the Fig-Implementation Guide and follows the 6502 Rev 1.1 sources as supplied by Fig, with additional definitions including double precision words, floating point and Colour/Graphics to take advantage of Atari's extra features.

Additional facilities include SAVE (which allows you to make a self-booting image of FORTH on disc and will include any new definitions you add) and DECOMP (decompile) in Debug. All of this is available for a modest £29.99 on disc and requires 24K RAM.

Yours faithfully,
Mike Wilding,
Atari International (UK) Ltd,
Slough.

Dear Sir,

One small error in the listing on page 33 of your July edition prevents this program from working.

The instruction on line 1370 should be followed by a semi-colon and not a colon as printed.

Yours faithfully,
T.I. Pothecary,
London SE19.

Dear Sir,

I am the owner of a Sharp MZ-80K, which I have owned now for over a year. Up to that date I have been unable to lay my hands on any REAL adventure programs, for example, the Mysterious Adventures series that you reviewed in the June '83 edition.

Please could you put me in touch with any software houses that could help me tax my brain by submerging me in a dark castle with only a bent nail to help me.

Yours faithfully,
Cpl May,
BFPO 43

(*If you contact the following software companies and browse through their catalogues, you'll doubtless find something to your taste. Kuma Computers, 11 York Road, Maidenhead, Berks (phone 0628-71778); Sumlock Bondain Ltd, 263 City Road, London EC1. —Ed. *)

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Wendy J Palmer

CLUB CALL

A lot of people go out and buy a microcomputer and *then* start to learn how to use it with the help of the manuals that accompany the machine and with the aid of other books and magazines. This can be a lonely and frustrating business which is why so many clubs have been formed up and down the country. Going to a club, whether you own a micro or not, is often the best way of learning how to get the most from your new 'toy'. And of course even the more experienced user can gain (and give) a lot. So keep your eye on this regular page for information about clubs in your area and if you don't see one why not start one and let me know about it.

HX-20 USERS GROUP
c/o 14 Courtleigh Gardens
London NW11 9JX

If there is anybody out there who owns or uses an Epson HX-20 for whatever purpose and would like to share their ideas or help others to realise the full potential of their machine you should contact the above group. When doing so please enclose your name and address, what you use the machine for and your occupation.

LIVERPOOL BBC & ATOM GROUP
Contact: Nik Kelly (Secretary)
Tel: 051-525 2934

This group now meets twice monthly: on the first Wednesday of the month at Old Swan Technical College, Room C 33, at 7.30 to 9.30pm, and on the third Thursday of the month, on the 1st floor of the Science and Maths Department of Birkenhead Tehnical College. For more information plus news of meetings, contact Nik.

INTERNATIONAL SORCERER INFORMATION SERVICE
84 Camberley Crescent
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Contact: Maurice Dow

Although strictly speaking not a club in the 'meeting' sense, ISIS is a non-profit medium (monthly newsletter) aimed at providing an exchange of information for current Sorcerer owners. Membership is $15 (Canadian funds in Canada, US dollars elsewhere). Each issue of ISIS will contain amongst other items a full length program listing, software reviews, requests for information and offers of help.

NATIONAL NEWBRAIN USER GROUP
6 Swanborough Place
Whitehawk
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Contact: J M Hudson (Secretary)
Tel: 0273-695351

This group would like to hear from other Newbrain users. The annual subscription is £5.00.

BRITISH APPLE SYSTEMS USER GROUP
PO Box 174
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Hertfordshire WD2 6NF
Contact: Membership secretary

The group is a national group and membership is open to existing and potential Apple users. On joining members receive an introductory disc or tapes of software containing some useful utilities and games assembled by members. Integer BASIC is included. A bi-monthly journal is produced called Hardcore. A software library is available, discs costing a nominal fee. Courses on various subjects are arranged at a nominal cost and special interest groups are being formed. At present the membership covers all areas of the UK and many countries abroad. The current membership fee is £12.50 plus a joining fee of £2.50 for new members. Anyone wishing to join from overseas should also enclose an extra £10 to cover the cost of airmail postage of magazines etc.

DAINAMIC PERSONAL COMPUTER USERS CLUB
Heide 4
3171 Westmeerbeek
Belgium

Although the DAI personal computer is not the most popular machine in the world this club has over 1,000 members all over Europe. A large magazine is published which in 1983 is primarily in English, and international meetings are held For more information contact Wilfried Hermans at the above address.

ROYAL AIR FORCE ASSOCIATION
HQ RAFSC
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Contact: Squadron Leader John Upham (Secretary)

Because of the interest in microcomputers among RAF personnel and the number of computer clubs at various RAF stations, an Executive Committe of the embryo RAF Computer Association has been formed. The Association has no connection with official Government computing, the objectives relating only to personal recreational computing. It hopes to achieve this through presentations, demonstrations, the promotion of competitions and facilities for the exchange of information, ideas and software. To this end the magazine Computair and its supporting broadsheet will both the published regularly.

TANGERINE USERS GROUP
1 Marlborough Drive
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Contact: Bob Green
Tel: 0934-21315

Anyone thinking of buying an Oric 1 will be pleased to hear that this group is supporting the machine. A monthly newsletter is produced and their Research & Development section aims to bring you up to date hardware add-ons at member discount prices. If you contact TUG however you should expect to wait for up to 14 days for a reply since they have been swamped by enquiries, so please be patient.

Why not write and let me know about your micro club. Send details such as the place and time of meetings, newsletters, special interests of members and particulars of the machines used, to me at the following address:

Club Call,
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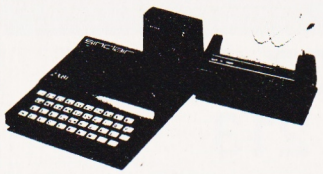
London WC2H 0EE



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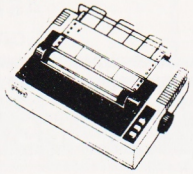

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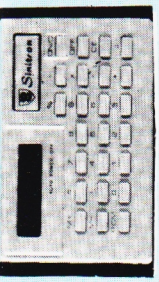

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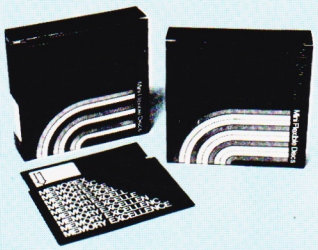

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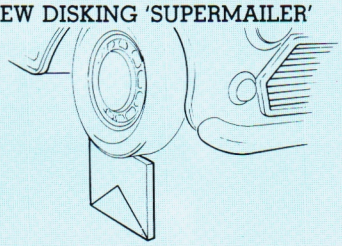

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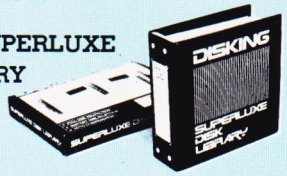

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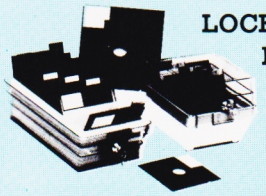

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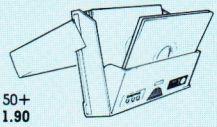

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